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FROM THE EDITORS

Probably most of those who finger through this journal are concerned with higher education and have views about its goals and their achievement. Herein I wonder about only one element: the fact that the exponential growth of general and specialized knowledge, concepts, and theory has now produced a sum total of beyond several lifetimes of even general education. All agree that careful selection from the overladen warehouse is essential, but the practical-minded and the idealists express different sentiments about the substance and philosophy of choice.

I think back to last spring at the time of the solemn graduation ceremonials at Iowa State University (and elsewhere) with their diverse incantations and exhortations. And I then asked, "What have the four or five years at Iowa State University really done for those who now march out into the 'real' world?" The answer came easily. It has equipped them with a bachelor's diploma that is an essential union card for many, if not most, professional opportunities. It has also, hopefully, provided technical training of some kind that puts the erstwhile student in competition in the job market—*education to make a living.* Students and many of their professors are in agreement about the necessity of such trade-school education. But this is not primarily what one hears in rhetoric from the graduation podium or in the voluminous, often pontifical, literature about the wonders of a liberal education—*education for living.* I recall a phrase from a graduation exercise a few years ago that is reasonably stereotypic, "We want our students to be liberated from provincialism, narrow-mindedness and myopia." Indeed we do! Amid the horde of currently expressed worthy ideals, no one perhaps has excelled Samuel Johnson, who, 250 years ago, said, "The supreme end of education is expert discernment in all things—the power to tell the good from the bad, the genuine from the counterfeit,and to prefer the good and the genuine to the bad and the counterfeit."

But how much of idealized nobility can be "taught"? To what extent is it genetically constrained? Were one of the objectives of education perceived as skill in the art of basketball, how much could said education materially help this writer (5 feet, 5 inches tall)? Indeed, one sometimes sees Ph.D.'s with the alleged souls of plumbers, and one also sees plumbers who never finished high school who, by comparison are wise men.

But if the polishing of souls is really possible, what constitutes effective processing? Courses or seminars in history, philosophy, political science, art appreciation, literature, or what for the science or technology-minded student? Or, if the individual is a liberal-minded major, how do the unpalatable sciences contribute to the holy state of "educated"? Turning to the Iowa State University Catalogue, Philosophy 230, *Moral Problems in the Modern World*, and Philosophy 460, *Epistemology and Metaphysics*, might seem reasonable candidates for some of the objectives of an ideal education, regardless of the major. But to what extent will exposure to these topics influence the subsequent health and happiness of the average student envisioning a career in business management, or the would-be aerospace engineer, or the fellow in the Farm Operations program who hopes to go back to hog production if Pop hasn't gone broke in the interim? Does anybody really know?

Then my mind moves up a month or so when a panel report from the National Endowment for the Humanities (in the United States) was published. Calling for a return of culture to the curriculum, the report asserts (partly paraphrased for brevity) "At too many campuses, course work is directed not with the purpose of becoming illuminated but just to get a job." *Just to get a job!* True, education at one time was primarily the privilege of the scions of the wealthy to whom *to get a job* may have been less than a pressing consideration. That is no longer the case, and the value of culture minus a job in present day society may be sadly constrained. To become *illuminated*! What if you are a 25-watt bulb when the pundits of bright light are seeking the glow of a 100-watt job?

This panel desires to "restore the humanities as the centerpiece of a full four-year curriculum;" it is nostalgic about the civilizations of classical Greece and Rome and the wisdom of illustrious philosophers; it recommends "a careful reading of great literature." I agree that at least some of this should be a component of the intellectual baggage of an "educated" person. But the "full four-year" curriculum, I fear, would have to become at least a six-year curriculum. Besides, in effect, the recommendation that everyone should go to church seems to be confused with being saved.

The Humanities Panel's statements are perhaps reasonable counter-reaction to current specializations in high technology, computer sorcery, business administration, etc., with little time for anything else. But they give the initial impression that their proponents have emerged from somewhere in the bowels of the past, maybe the middle of the nineteenth century. Then, only a relatively small number of people

went to a university, either just to become "educated" or preparatory for the major professions of that day, medicine, the ministry, and law. This was a time when Asa Gray, the botanist (but trained as an M.D.) and Longfellow, the poet, could chat across their backyard fences about common subjects other than the weather—or football had it then existed as a major element of culture. Now when the proportion of the population in many countries which attempts college may be as great as that who then finished grade school, colleges have done their best to adapt to the needs of times. The technical revolutions of the last one-hundred years have so augmented and diversified the necessary level of "training", if not education, that such preparation for life now becomes almost as necessary as once learning the three "R's" in grade school.

I know, I know. You may label me as decrier of the humanities, and I am not. Indeed it does seem that it is in the humanities we have failed. Our triumphs have been in science and technology; our failures in the humanities. We can put a man on the moon, but we cannot get along with one another; we live in a time of continuing crises and seemingly coming chaos. But is the reading of Spinoza, Schopenhauer, and Kant really relevant to the pressing needs of the present times that concern population, extravagant use of finite nature resources, despoilation of the living environment both for us and our renewable resources, and of course, the specter of atomic warfare?

But presumably there is a pot of gold at the end of the rainbow, and it is our obligation to keep trying to find it.

D.I.

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VOLUMETRIC DETERMINATON OF SEED WEIGHT IN SOYBEANS[1]

J.D. Hruskoci and W.R. Fehr[2]

ABSTRACT. The volume, weight, and moisture precentage of relatively dry and moist seeds of five soybean [*Glycine max* (L.) Merrill] cultivars were determined. Changes in seed volume were found to be proportional to changes in weight. The correlations between seed volume and moisture percentage ranged from 0.94 to 0.98. Variation in the ratio of weight to volume (seed density) showed no consistent relationship with changes in moisture percentage. Liquid displacement in a volumetric flask was found to be the most satisfactory method of determining seed volume. The primary advantage of the volumetric method compared with a weighing instrument is that the equipment is inexpensive and can be used as readily in the field as in the laboratory.

Index Descriptors: Soybean, *Glycine max* (L.) Merrill, seed moisture, seed density, liquid displacement, seed weight, volumetric determination of seed weight.

INTRODUCTION

Most cultivars of soybean [*Glycine max* (L.) Merr.] have a 100-seed weight of 12 to 18 g, but the range is from 4 to 55 g (Hartwig, 1973). Determinations of 100-seed weight generally are made in the laboratory on weighing instruments that are accurate to the nearest 0.1 g, but such equipment is expensive and readily available only in research centers. An inexpensive method for determining 100-seed weight would be useful where appropriate weighing equipment is not available, particularly for use in the field by agribusiness personnel.

The objective of our study was to evaluate the possible use of seed volume for estimating seed weight. It is well known that the volume of soybean seed changes with seed moisture, but there is no information available on the consistency of the ratio of weight to volume (seed density) over a range of moisture levels. This paper presents such information.

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[1]Journal Paper no. J-10207 of the Iowa Agriculture Home Economics Experiment Station, Ames, Iowa 50011. Project No. 2475. The research was supported in part by a grant from the Iowa Soybean Promotion Board.

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MATERIALS AND METHODS

The relationships between seed volume, weight, and moisture percentage were studied in three experiments. For experiment 1, two replications of 50 seeds were harvested from yellow pods of each of the cultivars 'Amsoy 71', 'Beeson', and 'Vinton', growing in the field at Ames, Iowa. The cultivars differ in 100-seed weight with Amsoy 71 having the lightest and Vinton the heaviest seeds. Seeds from yellow pods were chosen because they had a moisture content in excess of 40%. They provided an opportunity to determine if changes in seed density occur when extremely wet seeds are dried (Table 1).

For experiment 2, two replications of 50 seeds from mature pods of Amsoy 71, Beeson, and Vinton were harvested at Ames. These seeds were at a lower moisture percentage than those in expertiment 1 when the experiment began (Tables 1 and 2).

For experiment 3, two replications of 50 seeds from mature pods of Amsoy 71, Beeson, Vinton, 'Corsoy', 'Prize', and D66-5566 were harvested at Ames. The seeds were taken from plants that had been pulled at maturity and left outdoors for several weeks. The seeds were harvested when the pods were wet with rain to obtain a high moisture percentage (Table 3). The conditions were intended to simulate a soybean crop left in the field for several weeks after the crop had matured.

For each of the experiments, weight and volume of the 50-seed samples were measured immediately after they were harvested. Volume was determined to the nearest 0.01 cc with a Beckman Model 930 air comparison pycnometer. Samples were allowed to air dry initially at 25° C in open petri dishes. Weight and volume measurements were taken about every 24 hours. When the change in weight was small between sampling periods, the temperature was increased progressively up to a final temperature of 100°C for three days. The length of the drying period was 20 days for experiments 1 and 2, and 17 days for experiment 3. At the end of the 3-day period at 100°C, the seeds were assumed to be at zero moisture percentage. Moisture percentage at each of the previous sampling periods was computed as:

$$(1)\ \text{Moisture (\%) percentage} = \frac{\text{Weight of sample before drying} - \text{Weight of sample after drying}}{\text{Weight of sample before drying}} \times 100$$

Seed density at each sampling period was computed as the ratio of seed weight to volume.

Table 1. Mean moisture percentage, volume and density at 17 sampling periods for 50-seed samples of three soybean cultivars in experiment 1.

Sampling Period	Moisture	Volume	Density
	%	cc	g/cc
1	42.7	14.0	1.18
2	31.9	11.5	1.21
3	24.2	10.2	1.23
4	16.8	9.1	1.25
5	14.5	8.9	1.24
6	12.7	8.6	1.26
7	8.5	8.2	1.26
8	7.1	8.2	1.24
9	6.5	8.0	1.26
10	5.3	7.9	1.27
11	4.7	7.9	1.25
12	3.6	7.8	1.25
13	2.7	7.8	1.25
14	0.7	7.7	1.24
15	0.2	7.6	1.25
16	0.04	7.6	1.24
17	0.00	7.6	1.24
LSD[a]			0.01

[a]Least significant difference at the 0.05 probability level.

RESULTS AND DISCUSSION

There were significant differences ($P < 0.01$) for seed density among sampling periods and soybean cultivars in each of the experiments. The range in density among sampling periods averaged across cultivars was 1.18 to 1.27 in experiment 1 (Table 1), 1.24 to 1.28 in experiment 2 (Table 2), and 1.20 to 1.26 in experiment 3 (Table 3). Despite the significant differences among sampling periods, the variation in seed density did not show any consistent relationship with changes in moisture percentage across experiments, nor was it especially large. In experiment 1, the lowest seed densities were at the first sampling periods when moisture percentages were the

Table 2. Mean moisture percentage, volume and density at 17 sampling periods for 50-seed samples of three soybean cultivars in experiment 2.

Sampling Period	Moisture	Volume	Density
	%	cc	g/cc
1	21.0	9.6	1.26
2	15.8	9.1	1.26
3	13.9	8.8	1.26
4	12.1	8.7	1.25
5	11.2	8.6	1.26
6	10.5	8.5	1.26
7	7.9	8.2	1.26
8	6.9	8.3	1.24
9	6.3	8.1	1.26
10	5.3	8.0	1.28
11	4.7	8.0	1.26
12	3.6	7.9	1.26
13	2.8	7.8	1.27
14	0.7	7.8	1.25
15	0.2	7.7	1.25
16	0.04	7.7	1.25
17	0.00	7.7	1.24
LSD[a]			0.01

[a]Least significant difference at 0.05 probabilitiy level.

highest. For experiments 2 and 3, however, seed densities were slightly higher for the most moist seeds than for the driest ones.

The correlations between seed volume and moisture percentages across sampling periods ranged from 0.94 to 0.98 for the soybean cultivars in the three experiments (Table 4). There was a significant linear relationship between the two variables, indicating that changes in volume were proportional to the changes in moisture percentage. No significant quadratic relationships between volume and moisture percentage were observed. There were significant differences among soybean cultivars for the values of the linear regression coefficients (b), indicating that the amount of change in volume was dependent on the initial volume of the seed involved (Table 4). For example, an

Table 3. Mean moisture percentage, volume and density at 13 sampling periods for 50-seed samples of six cultivars in experiment 3.

Sampling Period	Moisture	Volume	Density
	%	cc	g/cc
1	33.0	11.1	1.22
2	15.1	8.5	1.26
3	10.4	8.2	1.23
4	8.0	8.1	1.22
5	7.1	8.0	1.22
6	6.6	8.0	1.21
7	6.5	8.0	1.20
8	4.9	7.7	1.23
9	4.6	7.7	1.23
10	4.3	7.7	1.23
11	3.2	7.7	1.21
12	0.1	7.5	1.20
13	0.0	7.5	1.20
LSD[a]			0.01

[a]Least significant difference at the 0.05 probability level.

increase of 1 percentage unit in the moisture of the small-seeded cultivar Amsoy 71 resulted in a smaller increase in volume than for a similar moisture change in the large-seeded cultivar Vinton.

These results indicate that seed volume can be used to estimate seed weight over a range of moisture percentages. Air or liquid displacement can be used to determine seed volume. Measurement of air displacement requires an air pycnometer, an instrument that is not widely available. Liquid displacement is the most practical and economical method of determining seed volume in soybeans.

We evaluated test tubes, beakers, graduated cylinders, and similar receptacles for measuring liquid displacement. The most practical container seemed to be a 500-ml volumetric flask. This flask has a bulb at the base that can readily hold 100 seed of any weight and a neck that is adequately thin to cause sufficient changes in the water level with small changes in seed volume.

In the calibration of a flask, an estimate of seed density is required. The average seed densities that we obtained were 1.24 in

Table 4. Correlation between seed volume and moisture and the linear regression of seed volume on moisture for soybean cultivars in three experiments.

Experiment-line	Correlation coefficient	Regression equation
Experiment 1		
Amsoy 71	0.98**	$Y^a = 5.99 + 0.109\ X$
Beeson	0.98**	$Y = 6.58 + 0.128\ X$
Vinton	0.97**	$Y = 9.19 + 0.174\ X$
Experiment 2		
Amsoy 71	0.98**	$Y = 6.66 + 0.079\ X$
Beeson	0.98**	$Y = 6.85 + 0.079\ X$
Vinton	0.97**	$Y = 9.34 + 0.112\ X$
Experiment 3		
D66-5566	0.94**	$Y = 4.36 + 0.054\ X$
Corsoy	0.96**	$Y = 5.81 + 0.089\ X$
Amsoy 71	0.97**	$Y = 7.08 + 0.117\ X$
Beeson	0.98**	$Y = 7.79 + 0.120\ X$
Vinton	0.98**	$Y = 8.60 + 0.105\ X$
Prize	0.98**	$Y = 10.00 + 0.149\ X$

**Significant at the 0.05 probability level.

[a]The linear regression equation was Y = a + bX, where Y = seed volume (cc) to be estimated, a = mean seed volume of the cultivar, b = linear regression coefficient, and X = moisture percentage of the seed sample for which seed volume is to be estimated.

experiment 1, 1.26 in experiment 2, and 1.22 in experiment 3. Smith and Weber (1968) reported an average seed density for soybeans of 1.27, and Fehr et al. (1968) reported an average seed density for soybeans of 1.24. The average seed density for the five studies was 1.25.

To calibrate any receptacle for estimation of 100-seed weight, enough water at room temperature is added to cover 100 soybean seeds of any volume that would be tested. A strip of paper that

extends upward from the level of the water is taped to the receptacle. The water level is marked on the paper at the base of the meniscus. The 500-ml mark at the base of the neck of a volumetric flask is a convenient place to denote the initial water level before any seeds are added. After the initial water level is marked on the paper, 1 ml of water is added and the base of the meniscus is marked on the paper. Additional 1 ml increments of water are placed in the container and the position of the meniscus is marked each time. The 1-ml marks on the paper strip are converted to seed weight, with each ml of volume equivalent to 1.25 g of seed of average density.

Variation in seed moisture will influence volume in direct proportion to seed weight; therefore, moisture percentage is no different a problem for liquid displacement than for weighing the seed. If different samples are to be compared directly, their moisture percentage should be uniform or should be determined before they are placed in the flask.

The primary advantage of the volumetric method compared with a weighing instrument is that the equipment is inexpensive and can be used as readily in the field as in the laboratory. One disadvantage is that the receptacle must be emptied and refilled for each determination; therefore, it is slower than a weighing instrument. Another disadvantage is that the volumetric method cannot acccount for variation in seed density. The volumetric method will be most useful when the number of samples is relatively small and an appropriate weighing instrument is not available.

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INHERITANCE OF GROAT-OIL CONTENT AND SEVERAL OTHER TRAITS IN INTER- AND INTRA-SPECIFIC OAT MATINGS[1]

Alan L. Elliott[2], Ann Marie Thro[3], and Kenneth J. Frey[4]

ABSTRACT. Valuable characters for cultivated oats (*Avena sativa*) may be obtained from the gene pool of *A. sterilis*, a wild, weedy, related species. All possible matings with reciprocals were made among two *A. sterilis* collections and four *A. sativa* lines with a range of groat (caryopsis)-oil contents from 2.0 to 9.5%. Hybrid and parental plants grown in a controlled-environment chamber were evaluated for days to heading, plant height, and percentages of groat oil and groat protein.

General combining ability was the major source of genetic variability for all traits, but specific combining ability also was a significant source of genetic variability for days to heading. General and specific cytoplasmic effects were infrequent and inconsistent for all traits. Heterosis was significant for days to heading, and there was dominance to overdominance for earliness. Most dominance values for groat-oil and groat-protein percentages were small.

Genotypic and phenotypic correlations showed that days to heading and plant height were positively and strongly associated and that groat-oil percentage was positively and moderately associated with days to heading and plant height. Groat-protein percentage was negatively correlated with all traits except groat-oil percentage.

Index descriptors: *Avena sativa*, *Avina sterilis*, oats. Plant height, Days to heading, Groat-protein percentage.

INTRODUCTION

The introgression of germplasm from weedy oats (*Avena sterilis* L.) into the cultivated oat (*A. sativa* L.) gene pool has become a part of several oat breeding programs. *A. sterilis* is a hexaploid species

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(2n = 42), native to the Medeterranean region, which mates compatibly with *A. Sativa* to produce fertile F_1's. It is agronomically undesirable because it shatters, has hairy lemmas, and lodges easily, but it does posess several desirable traits that can benefit cultivated oats. Frey (1982) and his colleagues (Frey *et al.*, 1979) have transferred eight genes for resistance to crown rust (causal organism *Puccinia coronata* Cda. var. *avenae* Frazier and Ledingham) from *A. sterilis* into multiline oat cultivars grown extensively in the midwestern U.S.A. Protein content in *A. sterilis* groats (caryopses) ranges as high as 30% (Briggle, 1971; Frey, 1977; Briggle *et al.*, 1975), whereas *A. sativa* cultivars contain a high of 20 to 23% (Briggle, 1971; Miller, 1958). Similarly, oil percentage in *A. Sterilis* groats may be as high as 11% (Thro, 1982), but in *A. Sativa* it normally ranges from 4 to 6% (Frey and Hammond, 1975).

In this study, we report cytoplasmic and nuclear gene inheritance of days to heading, plant height, and groat-oil and groat-protein contents in intra- and inter-specific matings among genotypes of *A. Sativa* and *A. Sterilis*

REVIEW OF LITERATURE

Brown and Aryeetey (1973) and Brown *et al.* (1974) found no significant cytoplasmic effect on groat-oil content in *A. Sativa* matings. They reported that general combining ability effects were large, indicating additive gene action in the inheritance of groat oil. However, Frey*et al.* (1975) found partial dominance for high oil content in *A. Sativa* × *A. Sterilis* matings. These authors reported inheritance of groat-oil content to be polygenic. Additional observations of additive gene action for groat-oil content of oats were reported by Baker and McKenzie (1972), Ahmed (1978), and Barrales Vega (1979). Brown*et al.* (1966) found a significant negative correlation between oil and protein contents in *A. Sativa* lines.

Frey *et al.* (1954), Ohm and Patterson (1973), and Tantivit and Frey (1974) found partial to complete dominance for low groat-protein percentage in oats. Campbell and Frey (1972) and Ohm and Patterson (1973) reported predominantly additive gene action in groat-protein inheritance, but duplicate epistatic gene action conditioned low groat protein in several interspecific matings. Tantivit and Frey (1974) found several instances of significant cytoplasmic effects on groat-protein content; the cytoplasm of one *A. Sterilis* line gave a 3.1 percentage unit groat-protein increase. Ohm and Patterson (1973) reported predominantly additive gene action in groat-protein

inheritance, but duplicate epistatic gene action conditioned low groat protein in several interspecific matings. Tantivit and Frey (1974) found several instances of significant cytoplasmic effects on groat-protein content; the cytoplasm of one *A. Sterilis* line gave a 3.1 percentage unit groat-protein increase. Ohm and Patterson (1973) observed no evidence for cytoplasmic effects. Frey *et al.*(1954) theorized complex inheritance for protein content in intraspecific matings, but Campbell and Frey (1972) theorized a simple system of inheritance in interspecific matings.

MATERIALS AND METHODS

Materials

Four *A. Sativa* and two *A. Sterilis* lines (Table 1) with a range of groat-oil contents were mated in all combinations with reciprocals (15 parental combinations with reciprocals = 30 combinations). The exact plants used in the matings also were allowed to self to provide parental seeds for the evaluation study. All six parents had plump groats.

Evaluation Experiment

For the exaluation experiment, F_1 and parental groats were treated with a fungicide (Terrachlor[5]), soaked, and held at 10° C for seven days to break dormancy. Next, the seeds were planted in 12.5 cm diameter clay pots and placed in a controlled-environment chamber. The growing medium was a 1:1:1 mixture of sand, peat, and loam. A plot was one pot sown with three hills of one to two seeds each. One hill contained F_1 seeds, and the other two were sown with the parents and used to make the F_1. After emergence, the seedlings were thinned until each pot contained one F_1 plant and one plant from each parent. Thus, there were 30 plots per replication. The experimental design was a randomized complete block with four replications.

In the controlled-environment chamber, fluorescent and incandescent light was provided for 16 and 15 hours per day, respectively. Day and night temperatures were 21° C and 18° C, respectively. Fertilizer (¼ tsp of 6:10:4 analysis) was applied to each pot weekly. About two

[5]Pentachloronitrobenzene. Mention of a trademark or proprietary product does not constitute a recommendation of the product by Iowa State University and does not imply its approval to the exclusion of other products that may also be suitable.

Table 1. Mean days to heading, plant height, groat-oil percentage, and groat-protein precentage for six parental oat lines.

Line	Species	Days to heading	Plant height (cm)	Groat oil (%)	Groat protein (%)
PI 324819	*A. sterilis*	54.4	89.5	6.1	28.5
PI 317735	*A. sterilis*	79.6	145.5	9.5	22.4
CI 9186	*A. sativa*	45.2	96.9	3.3	24.1
PI 197841	*A. sativa*	62.4	138.3	2.7	27.4
CI 4158	*A. sativa*	57.9	127.8	2.0	22.1
CI 6570	*A. sativa*	120.6	152.0	7.4	17.0
CV (%)[a]		12.5	9.7	18.3	11.3

[a]Coefficient of variability = $\frac{s}{\bar{X}}(100)$

Table 2. Variance analyses of data from F_1 plants for days to heading and plant height and from F_2 seeds for groat-oil and groat-protein percentages.

		Mean Square			
Source	df	Days to heading	Mature plant height	Groat-oil percentage	Groat-protein percentage
Among matings	29				
GCA	5	2455.5**	6946.4**	73.5**	83.3**
SCA	9	487.5**	750.0**	1.9**	15.6
GCE	5	12.4	114.7	1.0	25.6*
SCE	10	48.7**	499.7**	0.4	9.2
Residual	87	9.1	145.6	0.6	9.0
CV (%)[a]		5.4	9.8	13.7	13.0

*,** Significant at 5% and 1% levels, respectively.

[a]Coefficient of variability = $\frac{s}{\bar{X}}(100)$

weeks post anthesis, panicles of *A. Sterilis* lines and the hybrids involving them as parents were bagged to prevent seed loss from shattering.

At anthesis, number of days to heading (i.e., when the collar of the primary oat panicle exserted from the boot) was recorded for each plant. At maturity, plant height was measured (cm) from the soil surface to the tip of the uppermost spikelet (awns not included). A sample of 12 seeds from each plant was dehulled, dried for 40 hours at 50° C, and analyzed for oil content by the Nuclear Magnetic Resonance (NMR) method discussed by Alexander *et al.*(1967). The same seeds were redried for 17 hours at 60° C and analyzed for nitrogen content by an improved Kjeldahl (American Association of Cereal Chemists, 1962) method. Nitrogen values were converted to protein percentage by multiplying by 6.25.

Statistical Analyses

Data from parental plants were analyzed separately (a) to find whether parent plants within a line were genetically heterogeneous and (b) to provide a base for measuring F_1 heterosis.

Data from hybrid plants were analyzed by using the fixed model option of the diallel analysis presented by Griffing (1956). A mean square for heterosis with one degree of freedom was determined for each trait by contrasting the mean of the mating across reciprocals to the mean of the parents. The error term used to test heterosis was the pooled residual mean square for hybrids and parents.

Dominance values were calculated by using the potence ratio formula (Petr and Frey, 1966):

$$\text{Dominance} = \frac{(C - MP)}{(HP - MP)}$$

where C, MP, and HP are the means of mating, the parents of the mating, and the higher parent, respectively.

Phenotypic correlations for parents and matings for each pair of traits were calculated by using parental and cross means, respectively. Genotypic correlations for the crosses were calculated by using genotypic variances and covariances.

Tests of significance for mean squares, dominance values, and correltions were made by using F-, t-, and r- tables from Steel and Torrie (1960).

Table 3. General combining ability effects for days to heading, plant height, groat-oil percentage, and groat-protein percentage for the six parents

Line	Species	Days to heading	Plant height (cm)	Groat oil (%)	Groat protein (%)
PI 324819	*A. sterilis*	− 3.7**	−15.0**	+0.8**	+2.9**
PI 317735	*A. sterilis*	+ 5.2**	+15.8**	+2.2**	−0.5
CI 9186	*A. sativa*	− 8.3**	−15.7**	−0.9**	−1.0*
PI 197841	*A. sativa*	− 3.7**	+ 1.4	−1.2**	+0.9
CI 4158	*A. sativa*	− 4.9**	− 5.1*	−1.8**	−0.9
CI 6570	*A. sativa*	+15.4**	+18.6**	+0.8**	−1.3**

*, ** Significant at 5% and 1% levels, respectively.

RESULTS

Parental Performance

Groat-oil contents were 6.1 and 9.5% for the *A. Sterilis* lines, PI 324819 and PI 317735, respectively, and 3.3, 2.7, 2.0, and 7.4% for the *A. Sativa* lines, CI 9186, PI 197841, CI 4158, and CI 6570, respectively (Table 1), when grown in the controlled-environment chamber. Thus, the range of parental values was appropriate for conducting an inheritance study on groat-oil content.

Significant variation existed among parental lines and among the parent plants within-lines for all traits, but the variance components for among-lines were much larger than those for within-lines. Coefficients of variation (C.V.'s) for the parent analysis were 12.5, 9.7. 18.3, and 11.3 for days to heading, plant height, groat-oil percentage, and groat-protein percentage, respectively — values similar to those reported by Tantivit (1973) for a similar experiment.

Performance of Matings

Mean squares for general combining ability (GCA, the average performance of a parent in a series of crosses [Allard, 1960]) were highly significant for all traits, and those for specific combining ability (SCA, the deviation of a particular cross from predictions based on GCA) were highly significant for all traits except groat-protein percentage (Tables 3 and 4). Mean squares for general cytoplasmic effect (GCE) were nonsignificant for all traits except groat-protein

Table 4. Specific combining ability effects for days to heading, plant height, groat-oil percentage, and groat-protein percentage for oat matings.

Mating	Days to heading	Mature Plant height (cm)	Groat oil (%)	Groat protein (%)
PI 324819 × CI 9186	+ 3.6**	+10.3**	+0.1	−0.4
PI 324819 × PI 317735	+ 1.8*	+ 2.4	+0.9**	−2.2*
PI 324819 × PI 197841	− 2.8**	− 5.6	−0.5*	+0.5
PI 324819 × CI 4158	− 1.0	− 0.7	−0.1	−0.2
PI324819 × CI6570	− 3.5**	− 6.4	−0.4	+2.3**
CI9186 × PI 317735	− 3.9**	− 4.1	−0.2	+0.9
CI 9186 × PI 197841	+ 2.4**	+ 0.3	−0.2	+0.3
CI 9186 × CI 4158	+ 6.6**	+ 8.3*	0.0	+0.6
CI 9186 × CI 6570	− 8.6**	−14.8**	+0.2	−1.3
PI 317735 × PI 197841	− 5.3**	− 5.9	+0.2	−0.4
PI 317735 × CI 4158	− 8.0**	− 5.4	−0.6**	+0.6
PI 317735 × CI 6570	+15.5**	+12.9**	−0.3	+1.1
PI 197841 × CI 4158	+ 4.7**	+ 0.3	+0.4	+0.4
PI 197841 × CI 6570	+ 0.9	+10.9**	+0.2	−0.8
CI 4158 × CI 6570	− 4.2**	− 2.6	+0.3	−1.3

*,** Significant at 5% and 1% levels, respectively.

percentage, whereas those for specific cytoplasmic effect (SCE) were significant for days to heading and plant height but not for groat-oil and groat-protein percentages. For all traits, the GCA mean squares were significantly greater than those for SCA, GCE, and SCE.

Combining Ability. GCA effects were significant for all parent oat lines for days to heading and groat-oil percentage, and they were significant for five and three parents for plant height and groat-protein percentage, respectively (Table 3).

Correlations between GCA effects and direct performance of parental lines were 0.99, 0.94, 0.99, and 0.83 for days to heading, plant height, groat-oil percentage, and groat-protein percentage, respectively. All were highly significant, indicating that either all four traits were determined principally by additive gene action or that non-additive genetic effects caused a consistent reduction or increase in a trait value over all matings.

Among the 15 matings, 13 had significant SCA effects for days to heading, five for plant height, three for groat-oil percentage, and two for groat-protein percentage (Table 4). The large proportion of matings that showed significant SCA's for days to heading indicates that nonadditive gene action was important in the inheritance of this trait. On the other hand, nonadditive gene action was indicated as being of little importance in the inheritance of plant height, groat-oil percentage, and groat-protein percentage.

Cytoplasmic effects. Of the 24 parent-trait combinations, only two showed significant GCE's, and these two showed no consistent pattern, suggesting that general cytoplasmic effects were essentially nonexistent for any trait for this set of oat lines. Of the 60 mating trait combinations, eight had significant reciprocal effects, but there was no trend for significant effects to be associated with a specific trait. However, two matings, PI 317735 × PI 197841 and PI 197841 × CI 4158, each contributed significant reciprocal effects for two of the four traits. Also, PI 197841 and CI 4158 were each a parent in four of the eight matings that showed significant reciprocal effects. In general, cytoplasmic effects were not important in expression of the traits measured.

Heterosis and dominance. The mean square for overall heterosis was highly significant for days to heading, but not for plant height, groat-oil percentage, or groat-protein percentage. These results suggest that days to heading was affected by dominance but that the other three traits were not.

For days to heading, there was dominance for earliness in all matings and overdominance in five (Table 5). Note that all interspecific matings involving PI 197841 and CI 4158 showed overdominance for days to heading; this is the only instance of consistency in the inheritance pattern of any trait in the interspecific matings. For plant height, the degrees of dominance generally were partial for shortness; for groat-oil percentage, dominance tended to be positive but small, and for groat-protein percentage, it tended to be negative and partial.

Correlations. Genotypic and phenotypic correlations (Table 6) were similar in sign and magnitude for each pair of traits, and they showed three trends: (a) days to heading and plant height were associated positively and strongly (r_g = 0.89), (b) groat-oil percentage was positively and moderately associated with days to heading and plant height (r_g = 0.46 to 0.53), and (c) groat-protein percentage was negatively correlated with all traits except groat-oil percentage, for which there was no significant correlation.

Table 5. Degrees and directions of dominance for days to heading, plant height, groat-oil percentage, and groat-protein percentage in oat matings.

Mating	Days to heading	Mature Plant height (cm)	Groat oil (%)	Groat protein (%)
PI 324819 × CI 9186	−0.4	+2.4	+0.6	−0.8
PI 324819 × PI 317735	−0.6	+0.3	+0.9	−0.7
PI 324819 × 197841	−3.1	−0.4	0.0	−0.9
PI 324819 × CI 4158	−4.4	−0.4	+0.1	−0.1
PI324819 × CI6570	−0.7	0.0	−0.2	+0.7
CI9186 × PI 317735	−0.8	−0.1	0.0	−0.9
CI 9186 × PI 197841	−0.8	−0.4	+0.2	−1.5
CI 9186 × CI 4158	−0.3	−0.1	+0.2	−1.3
CI 9186 × CI 6570	−0.8	−0.5	+0.1	−0.3
PI 317735 × PI 197841	−2.2	−2.1	+0.1	−0.7
PI 317735 × CI 4158	−1.9	−1.0	−0.2	0.0
PI 317735 × CI 6570	−0.4	+6.5	−0.4	+1.0
PI 197841 × CI 4158	−3.4	−2.5	+1.1	−0.5
PI 197841 × CI 6570	−0.8	+1.2	0.0	0.0
CI 4158 × CI 6570	−0.9	−0.5	0.0	+0.1

Table 6. Genotypic[a] and phenotypic[b] correlations for days to heading and plant height from F_1 plants and groat-oil percentage and groat-protein percentage from F_2 plants.

Trait	Days to heading	Plant height	Groat-oil percentage
Plant height	0.89 (0.85**)		
Groat-oil percentage	0.53 (0.52**)	0.46 (0.45**)	
Groat-protein percentage	−0.22 (−0.18)	−0.34 (−0.32**)	0.00 (−0.04)

[a]Significance levels not determined for genotypic correlations.

[b]Phenotypic correlations and their significance levels in parentheses.

**Significant at 1% level.

DISCUSSION

Additive gene action accounted for most of the variability for days to heading in our oat matings, but dominance was consistent for earliness. Additive gene action accounted for most of the variability in plant height. Groat-oil percentage was additively inherited in both inter- and intra-specific matings, which corroborated the results obtained by Brown and Aryeetey (1973)) and Brown *et al.*(1974), who studied only *A. Sativa* matings. No evidence was found for any dominance for this trait such as Frey *et al.*(1975) reported for other interspecific matings. Groat-protein percentage was determined princ-ipally by additive gene action with some trend for partial to complete dominance for low protein content. These results corroborate the patterns of inheritance that Ohm and Patterson (1973) and Campbell and Frey (1972) reported for groat-protein percentage.

PI 317735 and PI 324819 had high GCA effects for groat-oil and groat-protein percentages, respectively, so they probably would be valuable sources of genes for breeding programs designed to increase these traits in oats.

Days to heading and plant height were measured on F_1 plants, in which case cytoplasmic and maternal effects of the parent plants would be confounded. However, groat-oil and groat-protein percent-ages were determined of F_2 seeds. Consequently, the maternal effects of the female parent on these traits should have been sufficiently dissipated. Differences between reciprocal crosses for a mating should have represented almost exclusively cytoplasmic effects. Three of the eight mean squares for GCE and SCE were significant, but when parents and matings were evaluated individually for GCE and reciprocal effects, there were few instances of significance and no consistent trends for plasmagene and (or) female parent influence on expression of any trait.

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POTENTIAL HARVESTABLE VOLUMES AND MANAGEMENT IMPLICATIONS FOR THREE UPLAND TIMBER TYPES IN EASTERN IOWA[1]

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ABSTRACT. More than 50% of the standing volume in the white oak-red oak-hickory, white oak, and hard maple-basswood timber-types in eastern Iowa is available for harvest under recommended silvicultural prescriptions. Evaluation of the economic classes of trees which could be removed indicates that adherence to these prescriptions would not high-grade the stands. The high percentage of total volume which could be removed under recommended management prescriptions, indicates that the stands are primarily mature and overmature from a silvicultural point of view. Increased use of patch clearcutting and increased investment in timber stand improvement early in the life of the new stands will be necessary if an oak component is desired in succeeding stands. If these techniques are not accepted by landowners, there will be declines in the acreage of oak timber-types as stands shift to the hard maple-basswood timber-type.

Index descriptors: management, timber management, oak, oak management, upland oak, upland timber, Eastern Iowa.

INTRODUCTION

Two major inventories of Iowa timberland were conducted in 1954 and 1974 by the United States Forest Service (USDA-FS). Iowa's commercial timberland acreage decreased in the 20 years between inventories by dropping from 2,296,800 acres in 1954 to 1,458,700 acres in 1974. This loss was caused primarily by the conversion of forest to pasture and other agricultural land uses. As a result of the decline in commercial timberland area, the yield of wood products is expected to decrease further unless management practices on the remaining forest areas are intensified (Spencer and Jakes, 1980).

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Table 1. Area of commerical timberland by ownership class (Ostrum, 1974).

Ownership Class	Area (acres)
Public	111,200
Forest industry	16,700
Farmer	987,000
Miscellaneous private	343,800

Most of Iowa's commercial timberland is located along the Mississippi and along the eastern half of the Iowa-Missouri River border. Table 1 shows that ownership of the commercial timberland is divided among four ownership classes, of which farmers own approximately two-thirds (Ostrom, 1974).

Two-thirds of the commercial forest land is located on the upper slopes and steep side slopes, with the remaining one-third on the lower slopes and level ground. Of the commercial forest area, approximately 56% is classified in the two oak types, oak-hickory and white oak. Among the farmer and other private holdings, some 788,200, are 50-2,500 acres in size (Spencer and Jakes, 1980). These holdings are large enough to provide management opportunities.

The objective of this study was to estimate the potential volumes of veneer, sawtimber, and fuelwood or pulpwood which could be marketed under management from existing hardwood stands in Iowa woodlands without detrimental effects on the resource base.

METHODS AND MATERIALS

Forest land is defined as any land of at least two continuous acres, at least 120 feet wide along the shortest axis, at least 15% covered by visible tree crowns, as shown on an aerial photograph, with forest trees of any size, and not developed for intensive recreation, such as city parks (Spencer and Jakes, 1980). Commercial forest land is defined as that forest land producing or capable of producing crops of industrial wood in excess of 20 cubic feet per acre per year. This land must not be withdrawn from timber utilization by statute or regulation (Spencer and Jakes, 1980).

Ninety-one plots of a one-fifth acre size were established in the counties having more than 30,000 acres of commercial forest land (Spencer and Jakes, 1980): Allamakee, Winneshiek, Clayton, Dubuque, Jackson, Lee, and Van Buren counties. The plots were allocated to counties in proportion to the commercial forest acreage present.

Sample plots were selected systematically in each county by overlaying a dot grid on a Soil Conservation Service aerial photograph index sheet. The dot grid had a ground separation distance between dots of 1.2 miles. Plot centers were used to determine which vegetation-type the plots were in. Sample plots were distributed evenly across each county, their centers being pin-pricked on the aerial photos for the field location.

These sample plots were located in the field using a hand compass and chain to traverse to plot centers from identifiable landmarks not more than ten chains from the plot centers. Once plot centers were located, the centers were permanently marked with cedar stakes and referenced to nearby trees marked with aluminum tags nailed below stump height. Plots on the edge of a timber-type were treated as partial plots.

After each plot was located, it was typed into one of the following:

1. White oak—red oak—hickory: white oak, northern red oak, black oak, northern pin oak, burr oak, shagbark or bitternut hickory, singly or in combination, constitutes a majority of the stocking.
2. White oak: white oak constitues more than 50% of the stocking in the oak-hickory type.
3. Hard maple—basswood: sugar maple, black maple, or basswood, singly or in combination, consitutes a majority of the stocking.

Species, diameter at breast height (dbh), merchantable height, and total height were recorded for each tree on each plot. Live trees or dead trees which had sound wood with a dbh of four inches or greater were classified as veneer, sawtimber, fuelwood, or cull. The percentage of each tree's volume in each class was recorded. Classification of a part of a tree into a utilization class excluded that part of a tree from other classes. Each tree equal to or greater than 4 inches dbh was put into one of four crown classes: dominant, codominant, intermediate, and suppressed. Those trees equal to or greater than four inches in dbh had total height and merchantable height measured to the nearest foot with a clinometer.

Merchantable height determinations depended upon the merchantability class for the tree. The veneer class consisted of veneer material from trees with a dbh of 16 inches or greater that had at least one 4-ft butt section of clear bole. Merchantability increments for veneer were established as 4-ft sections. The sawtimber class was made up of trees with a dbh of 11 inches or greater, and bole lengths not classified as veneer when dbh is 16 inches or greater. To be classed as sawtimber, a tree must have had at least one 8-ft section of useable bole with a top diameter of eight inches or more. Increments of mechantability for sawtimber were established as 2-ft sections with 1 foot for trim per 16-ft log. Four inches was the lower limit for the fuelwood class. Merchantable bole height was to four inches top diameter, and limbs were included to a minimum of two inches. Fuelwood did not include the hollow or rotten parts of trees. A cull tree as defined as a tree that had no usable products.

Veneer and sawtimber volumes could occur only in living trees, but fuelwood volume could occur in either living trees or dead trees with reasonably sound wood. Volume of sawtimber and veneer was determined by using International ¼ log volume tables developed by Gervorkiantz and Olsen (1955) for the Lake States. Volume tables prepared by Mize and Prestemon (1981) were used to determine fuelwood in cords for whole trees and for the tops of trees.

Each tree equal to or greater than four inches dbh was put into one of three economic condition classses: good, fair, or poor. Good trees are described as acceptable growing stock by Roach and Gingrich (1975). This class consists of those trees that are marketable, being of desirable species, form, and quality, and are either crop trees or potential crop trees. The fair and poor classes correspond to undesirable growing stock as described by Roach and Gingrich (1975). The fair class is characterized by damaged, diseased, dying, or otherwise stressed trees that contain salable material or trees that are mature. These trees are not wanted in the stand now or in the future as crop trees. The poor class is defined as undesirable species that contain little salable product or are dead.

Dbh was measured to the nearest one-tenth inch on all trees four inches or greater at 4.5 feet above the ground. Forked trees were measured as two separate trees if the fork was at or below 4.5 feet, and the diameter was taken three feet above the crotch. Forked trees were treated as one tree when the fork occurred above 4.5 feet, and only one main stem of the fork was measured.

Basal area was determined for each plot by using a 10-factor prism.

While on each plot, the best silvicultural prescription, based on Roach and Gingrich (1975), was determined for the site. Prescriptions

were selected such that stands would be improved without detrimental effects to the resource base. Prescriptions were classified as: delay action for ten years, clearcut, shelterwood cut, seed tree cut, precommercial thinning, commercial thin from above, or commercial thin from below. Those trees designated for possible cutting were trees that had to be harvested to implement the presciption indicated.

RESULTS

Thirty-two species or species groups were encountered on the 91 sample plots. White Oak (*Quercus alba*), northern red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), hard maple (*Acer saccharum, A. nigrum*), elm (*Ulmus americana, U. rubra, U. thomasii*), and American basswood (*Tilia americana*) accounted for the majority of the trees.

In this study, the coefficient of variation of the mean total volume per acre and the coefficient of variation of the mean total volume removed per acre were similar to the estimate of sampling error in the 1974 U.S. Forest Service inventory (Ostrom, 1974). Thus our findings can be related directly to those of the much larger U.S. Forest Service study. The value for the coefficient of variation of the mean, as a general rule, increased when total volume present and total volume available for removal were subdivided by timber-type, management prescription, utilization type, and species.

Table 2 shows estimates of the average volume per acre which could be removed from each timber type by applying the best prescription for each individual site, and Table 3 shows the volumes in each timber-type which would be removed by each management prescripion if the best prescription for each individual site were applied.

DISCUSSION

Estimated volumes per acre that could be removed from Iowa forest land by utilization class in specific timber-types were analyzed. The largest fuelwood and sawtimber volumes per acre which could be removed were in the hard maple-basswood timber-type while the largest removable veneer volume per acre was of the oak timber-type. Responsible factors probably include the fact that the hard maple-basswood stands were not old enough to be producing large quantities of veneer-quality material and that hard maple-basswood stands typically were more densely stocked than the oak or oak-hickory sites.

Table 2. Estimated average volume per acre of fuelwood, sawtimber, and veneer that could be removed from three selected Iowa timber-types if prescribed management prescriptions were utilized. Coefficient of variation of the mean is given in parentheses beside each value.[a]

TIMBER TYPE	UTILIZATION CLASS		
	Fuelwood (cords)	Sawtimber (boardfeet)	Veneer (boardfeet)
White oak—red oak—hickory	9.57 (12.54)	1271.93 (22.70)	99.54 (56.65)
White oak	10.24 (11.85)	1284.42 (22.87)	216.10 (48.97)
Hard maple—basswood	12.33 (19.89)	2209.46 (27.67)	112.03 (62.79)

[a]coefficient of variation = $\frac{\text{standard deviation}}{\text{mean}} \times 100$

coefficient of variation of the mean = $\frac{\text{coefficient of variation}}{\sqrt{\text{mean number of samples}}}$

To see how much volume could be removed by individual management prescriptions within a timber-type, the volumes were broken down by prescription within each timber-type (Table 3). The "delay action" prescription in all timber-types had fuelwood volume that could be removed. This is the volume present in dead trees on sites which need no treatment for the next ten years. Such wood is sound and can be used as fuelwood if salvaged in the immediate future.

In the oak-hickory timber-type, the clearcut management prescription yielded the largest volumes per acre which could be removed for all utilization classes. This would be expected because everything on these sites would be taken whereas the other management prescriptions would result in at least some remaining volume on the site after the prescription was implemented.

The volume of each species which could be removed from each timber-type by each management prescription was determined. In the oak-hickory timber-type, the white oak species had the greatest veneer and sawtimber volumes which could be removed under the clearcut management prescription. This results from many white oak trees being large and overmature. The largest fuelwood volume was found in shagbark hickory, and this species contained the second

Table 3. Estimated average volume per acre of fuelwood, sawtimber, and veneer that could by removed under each management prescription from three selected Iowa timber-types if prescribed management prescriptions are utilized. Coefficient of variation of the mean is given in parentheses beside each value.

TIMBER TYPE (management Prescription)	UTILIZATION CLASS Fuelwood (cords)		Sawtimber (boardfeet)		Veneer (boardfeet)	
White oak—red oak—hickory						
Delay action	0.27	(75.36)	0.00		0.00	
Clearcut	12.50	(16.91)	1886.96	(33.94)	235.59	(57.12)
Shelterwood cut	10.89	(14.96)	1611.39	(30.57)	0.00	
Seed tree cut	8.87	(32.74)	944.00	(58.55)	0.00	
Precommercial thinning	6.80	([a])	0.00		0.00	
Thin from above	10.77	(24.60)	1211.84	(35.80)	25.29	(100.00)
Thin from below	4.95	([a])	0.00		0.00	
White oak						
Delay action	0.18	(86.73)	0.00		0.00	
Clearcut	15.68	(13.62)	2111.74	(27.33)	370.17	(69.55)
Shelterwood cut	9.18	(21.95)	994.15	(82.21)	0.00	
Seed tree cut	6.91	(7.71)	370.20	(38.72)	279.02	(48.38)
Thin from above	8.76	(19.11)	1582.79	(44.27)	140.76	(68.74)
Thin from below	5.71	(33.94)	187.15	(62.17)	0.00	
Hard maple—basswood						
Delay action	0.55	(90.91)	0.00		0.00	
Clearcut	16.89	(21.29)	3100.73	(31.16)	77.48	(72.46)
Shelterwood cut	20.35	(35.14)	4523.20	(42.86)	630.00	(100.00)
Seed tree cut	6.73	(39.78)	1490.90	(71.99)	97.30	(100.00)
Thin from above	10.55	([a])	312.00	([a])	0.00	
Thin from below	8.20	([a])	414.75	([a])	0.00	

[a]Class had only one plot so no coefficient of variation of the mean could be calculated.

largest sawtimber volume. Shagbark hickory trees, though generally smaller than the white oaks, are still in the sawtimber class, and many below the sawtimber diameter limit can furnish large volumes of fuelwood.

In the oak timber-type, the largest volumes per acre for all utilization classes again were under the clearcut management prescription. As in the oak-hickory timber-type, the clearcut prescription takes everything, whereas the other management prescriptions leave some volume for protection of the site or as a seed source for regeneration. The largest volume that could be removed from any one species in the clearcut prescription was from white oak for the veneer and sawtimber utilization classes. Elm had the largest volume that could be removed in the fuelwood class. By definition, the oak timber type had more than 50% of its stocking as white oak. Thus, white oak predominated among trees that were in, or could attain, the veneer class and would be expected to have a greater number of large trees that would produce sawtimber and veneer volume. Considerable fuelwood volume would be expected also because of the quantities of material salvagable from tree tops. The elm fuelwood potential is larger, however, probably because of the large number of elms dead or dying from Dutch Elm Disease.

In the hard maple-basswood timber-type, the largest volumes per acre removed were not from the clearcut prescription, but from the shelterwood prescription. Because everything is removed, the clearcut prescription would be expected to result in removal of larger volumes per acre than other cutting methods. However, the clearcut prescription was applied most frequently on areas that had relatively low levels of stocking while the shelterwood prescription was applied most frequently to plots with higher levels of stocking. The lower levels of stocking in the clearcut areas resulted in lower volumes removed per acre. In the other prescriptions used in this timber-type (e.g., seed tree cut, thin from above, and thin from below), the trees that could be removed were typically smaller in diameter and yielded small volumes per acre in all utilization classes.

In the hard maple-basswood timber-type, the largest veneer volume could be taken from the red oak species, the largest fuelwood volume could be taken from elm, and the largest sawtimber volume could be taken from American basswood. This pattern was possibly attributable to past harvests that opened the stands and allowed the hard maple and basswood to occupy the site. Previous stands likely were those of oak that had been severely high-graded approximately 70 years ago. Red oak trees present are probably residuals. Hard

maple and basswood regeneration seemingly has out-competed oak regeneration, and only large, mature oaks remain. Certainly current regeneration is primarily of the more tolerant hard maple and basswood.

For the landowner interested in timber production, the development of the hard maple-basswood stand where an oak stand had been is not necessarily detrimental. Hard maple can be sold as veneer, grows to heights near 110 feet, and can perpetuate itself in the understory because of its shade tolerance. However, for the landowner interested in the production of oaks for wood utilization, aesthetics, or wildlife mast production, shifting from oak to hard maple may be very detrimental. With loss of the acorn crop, many wildlife species, such as deer, squirrel, and turkey, may either decrease in number or move from this stand to one having greater mast production.

Landowners who want an oak component to remain in a hard maple stand may have to perform intensive management. This includes identifying oak seedlings as soon as possible and controlling competition around them. This treatment will have to be repeated until the oak trees are in the codominant crown class and can compete with the hard maple trees. The operator must realize that complete conversion back to an oak stand may never occur because of the propensity of hard maple to seed in from the sides of the stand, survive in the understory for long periods, sprout from the stumps and roots of the trees that are cut, and out-compete oak seedlings when in the understory.

In the hard maple-basswood timber-type and under the shelterwood cut, the red oaks could be removed because they are large, near maturity or mature, and do not serve effectively as seed trees with the hard maple trees that are present. Also, the basswood trees could be removed because they were not the most valuable crop trees. Basswood stands generally are more densely stocked than red oak stands because of the ability of basswood to produce multiple stump sprouts and large seed crops each year. Thus basswood can serve as a source of large quantities of fuelwood and sawtimber since it is not used as veneer. The utilization of elm, as previously explained, is limited primarily to that of fuelwood.

Volume Removed by Crown Class

When the volume that could be removed per acre was classified by crown class, the largest volumes available for removal were in the

dominant crown class, and the smallest were in the suppressed class. The average volume per acre that could be removed from each timber-type by crown class was estimated. The largest volumes for fuelwood and sawtimber utilization were found in the hard maple-basswood timber-type classes. The largest for the veneer utilization class was in the oak timber-type.

The oak-hickory and oak timber-types, with the largest volumes available for removal from the dominant crown class, yield but small amounts from the other crown classes. This may mean that these stands have been left undisturbed a relatively long time, allowing crown closure and competitive death to control the remaining understory or that control of the understory has been by grazing.

The hard maple-basswood timber-type has the largest average volume per acre available for removal under the shelterwood cut. There is a larger volume in the codominant, intermediate, and suppressed crown classes found under the clearcut management prescription, but there is not always an adequate amount of advanced regeneration. Therefore, a more common prescription is one designed to help establish increased regeneration such as the shelterwood cut.

Volume Removed by Economic Class

The values in Table 4 were calculated by dividing the estimated volumes that could be removed by the estimated total volumes. As the table shows, the largest percentages are being removed from the poor and fair economic classes. This shows that the presciptions that should be used to bring the sites under intensified management are not high-grading the stands because the residual stands are comprised predominantly of the better trees.

Table 4 also shows that more than 50% of all economic classes could be removed, indicating that stands in these timber-types are primarily mature and overmature from a silvicultural point of view. These data indicate that it is critical that landowners cease grazing forested areas to allow advanced regeneration to become established. Advanced regeneration will aid in establishing succeeding stands quickly, thus shortening the subsequent rotation. If oak is desired in succeeding stands, there is the further consideration that one can be reasonably assured of the presence of oak in succeeding stands only under one of two conditions: (1) advanced oak regeneration at least 4 feet tall at the time of cutting the mature overstory or (2) some

Table 4. Estimated percent of total volume that could be removed by utilization class and economic condition class in three selected Iowa timber-types.

Economic Class	Fuelwood (cord)	Sawtimber (boardfeet)	Veneer (boardfeet)
Good	60.5	53.9	56.0
Fair	68.7	69.2	0.0
Poor	85.9	91.4	0.0

combination of clearcutting and planting. Obviously, advanced regeneration is the least expensive method of establishing a new stand.

With the propensity of landowners to clear land, there will be strong temptations to convert to rowcrop or pasture following clearcutting. This temptation can be minimized and the income from the woodlot spread over the next few years by periodic harvests of small clearcuts (1-3 acres) to release patches of oak regeneration when they occur. If no advanced oak regeneration occurs, the landowner may be forced to a combination of small patch clearcuts and planting or allowing the stand to shift to hard maple-basswood type.

CONCLUSION

The study is based on 91 plots in three upland timber-types. The volumes obtained were divided among three economic classes, four crown classes, and seven management prescriptions. The volumes were obtained from 32 different species or species groups.

More than 50% of the standing volume in the study area in the white oak-red oak-hickory, white oak, and hard maple-basswood timber-types is available for harvest under recommended silvicultural prescriptions. This indicates that these timber-types are primarily mature and overmature from a silvicultural point of view. The largest sawtimber and fuelwood volumes present and the largest sawtimber and fuelwood volumes available for removal are found in the hard maple-basswood timber-type. The largest veneer volumes present and volumes available for removal are from the oak timber-type.

The largest percentage of class volume available for removal is in the poor and fair economic classes, indicating that the prescriptions

are not high grading the stands. However, the largest volume present and the largest volume available for removal are in the good economic class.

Dominant and codominant crown classes had very similar numbers of trees. The remaining two classes, intermediate and suppressed, have dramatically fewer trees. The dominant crown class has the largest volume present and volume that could be removed.

Implications for management of these timber-types are as follows.

1. More than 50% of the total volume in the timber-types studied could be removed under recommended management prescriptions, indicating that the stands are silviculturally mature and overmature. This makes it critical that landowners cease grazing forested areas to allow advanced regeneration to become established so succeeding stands can be started quickly.

2. There is some indirect evidence that many stands that were possibly classified as oak or oak-hickory timber-types 70-100 years ago may have shifted to hard maple-basswood timber-type. This may have resulted from the inability of oak regeneration to compete in the understory with hard maple and basswood. As a result, composition of the stands shifted to hard maple-basswood, and the process will continue unless intensive management of oaks is practiced by landowners. Conversion of the hard maple-basswood stands back to oak stands may be impractical or nearly impossible.

3. Increased use of patch clearcutting and increased investment in timber stand improvement early in the life of the stand will be necessary if an oak component is desired in succeeding stands. If these techniques are not accepted by landowners, there will be further declines in the acreage of oak timber-types and further increases in the acreage of the hard maple-basswood timbertype.

4. With the propensity of landowners to clear land, there will be a stong temptation to convert mature stands to rowcrop or pasture. If oak is desired in succeeding stands, this temptation can be minimized and the income from the woodlot spread over several years by periodic patch clearcuts to release oak regeneration that occurs. If oak is not desired, selection cutting could be used to obtain periodic income and allow the stand to shift to hard maple-basswood.

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SUMMER AND FALL HOOP NET CATCHES OF FISH IN THE UPPER MISSISSIPPI RIVER[1]

Wayne A. Hubert[2], and Dennis N. Schmitt[3]

ABSTRACT. Catch patterns and length frequencies are described for 12 species caught in two types of hoop nets during summer and fall in channel habitats of the Upper Mississippi River. The catch of six species appeared to be influenced by unpredictable environmental variables such as current velocity and turbidity. Four species exhibited catch patterns associated with seasonal changes in water temperature. Size selectivity of the two gear types was documented for 12 species.

Index descriptors: fish, sampling, hoop nets, catch, frequencies length, river, Mississippi River.

INTRODUCTION

Hoop nets have been proposed as monitoring gear for channel-dwelling fishes in the Upper Mississippi River (Jackson et al., 1981). Monitoring of fish stocks with hoop nets assumes that catch per unit effort (CPUE) is a measure of species abundance. Hoop nets are passive gear depending on the movement of fishes; any factor that influences movement also influences CPUE. The CPUE of hoop nets of a particular design has been shown to vary in relation to season, water temperature, current velocity, river stage, turbidity, dissolved oxygen, and sampling location (Muncy, 1957; Funk, 1958; Mayhew, 1973; Hubert and Schmitt, 1982; and Pennington et al., 1983).

Managers responsible for monitoring programs in which hoop nets are used can hope to reduce the variability of hoop net catches by establishing sampling regimes that control the time of sampling or the water temperatures at which sampling is done. Information on seasonal patterns of hoop net catches can give managers insight into how to set up monitoring programs and how to interpret results. Published

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information on seasonal patterns of hoop net catches for the Upper Mississippi River or its tributaries is limited. Some aspects of seasonal variation in catches of channel catfish (*Ictalurus punctatus*) and common carp (*Cyprinus carpio*) have been described for Des Moines River populations (Mayhew, 1973). Monthly trends in channel catfish catches have been documented for several Upper Mississippi River pools (Helms, 1973). The influence of sampling period on CPUE of several species in Pool 9 of the Upper Mississippi River was described by Hubert anf Schmitt (1982), but detailed information on seasonal patterns was not presented. We are unaware of any published information on the size-selectivity of hoop nets in the Mississippi River or in similar habitats.

The purpose of this paper is to describe the temporal catch patterns and length-frequency distributions of species frequently captured in two types of hoop nets fished in summer and fall in channel habitats of the Upper Mississippi River. Summer and fall tend to be seasons of relatively stable water conditions with reduced probability of floods, and rapid changes in fish distribution and movement patterns associated with spawning are less likely to influence catch. Monitoring programs could probably rely on sampling conducted during summer or fall.

METHODS

This study was conducted in three riverine reaches of Pool 9 encompassing river miles 661.2-664.6, 665.4-667.1 and 670.0-671.6. Habitats in both main-channel border and in flowing side-channels were sampled in each reach. Five main-channel border and five side-channel locations were sampled simultaneously with two types of hoop nets within a study reach. Nets were set for three consecutive days, and the catch was removed daily. Sampling rotated weekly from the upper reach to the middle reach to the lower reach from July through October 1980. A sampling period was defined as a 3-week interval during which all three reaches were sampled.

Two types of hoop nets were used, "bait nets" and "buffalo nets." Bait nets were constructed of 3.8-cm mesh (bar measure) netting with seven hoops ranging in diameter from 0.9 m at the mouth to 0.6 m at the cod end. Bait nets had two finger throats and were baited with cheese. Buffalo nets were made of 7.6- to 4.4-cm mesh netting from mouth to cod end, with hoop diameters declining from 1.2 to 1.0 m over the length of the net. Buffalo nets were constructed with two square throats and were baited with soybean cake. The net types were

set in tandem at each sampling location, with the bait net 25 m downstream from the buffalo net. The total length of all fish collected was measured to the nearest millimeter.

RESULTS AND DISCUSSION

Current velocity, water temperature, turbidity, and dissolved oxygen levels were measured in midchannel of both main- and side-channel habitats on each sampling day (Figure 1). Only current velocity varied significantly between the two habitat types.

Temporal Patterns

Six species (Table 1) made up 93% of the total bait net catch; ten species composed 94% of the total catch with buffalo nets. The mean catch per bait net varied significantly between sampling periods (analysis of variance, $P \leq 0.10$) for three of the six species most often caught in bait nets: black crappie, freshwater drum, and flathead catfish (Figure 2); and for 3 of the 10 abundant species caught in buffalo nets: shorthead redhorse, smallmouth buffalo, and black crappie (Figure 3).

Shorthead redhorse catch was similar for both hoop net types. The period of minimum catch corresponded to an interval of high flow rates (maximum current velocities in channel habitats 60-80 cm/second) and high turbidity (> 50 Jackson Turbidity Units). Hubert and Schmitt (1982) observed turbidity to account for significant variation of CPUE of shorthead redhorse and to have a negative influence of CPUE in their multiple-regression analysis.

The black crappie catch was also higher during the interval of high flow rates and turbidity in fall. The catches were smallest in late October when mean water temperatures were about 7° C.

Freshwater drum catches were lowest in mid-September when water temperature was around 17° C and the highest current velocities were observed. Hubert and Schmitt (1982) found that current velocity accounted for significant variation in CPUE and had a negative influence on CPUE in their regression analysis.

Smallmouth buffalo catches increased sharply from July through late August but declined progressively thereafter. The catch was largest when current velocities and turbidity were at moderate levels and water temperature exceeded 20° C. Regression analysis by Hubert and Schmitt (1982) identified water temperature as significantly accounting for variation in CPUE of freshwater drum.

Table 1. Numbers of fish caught in bait nets and buffalo nets during five periods in summer and fall, 1980 (90 net-days per period.

	Period				
	July 22-Aug 7	Aug 11-Aug 26	Sept 2 Sept 18	Sept 22-Oct 9	Oct 13 Oct 30
BUFFALO NETS					
Shorthead redhorse (*Moxostoma macrolepidotum*)	124	108	75	53	169
Black crappie (*Promoxis nigromaculatus*)	31	22	101	458	12
Freshwater drum (*Aplodinotus grunniens*)	86	72	37	72	88
Bluegill (*Lepomis macrochirus*)	4	2	32	31	0
Smallmouth buffalo (*Ictiobus bubalus*)	15	167	61	31	20
Mooneye (*Hiodon tergisus*)	19	11	19	17	31
Common carp (*Cyprinus carpio*)	2	2	0	17	22
Quillback (*Carpiodes cyprinus*)	14	6	11	3	6
Silver redhorse (*Moxostoma anisurum*)	9	3	4	5	4
Walleye (*Strizostedion vitreum vitreum*)	5	1	3	2	10

(Continued on following page).

Table 1. Continued from previous page.

	Period				
	July 22-Aug 7	Aug 11-Aug 26	Sept 2 Sept 18	Sept 22-Oct 9	Oct 13 Oct 30
BAIT NETS					
Shorthead redhorse (*Moxostoma macrolepidotum*)	150	90	91	72	145
Black crappie (*Pomoxis nigromaculatus*)	23	6	26	173	2
Freshwater drum (*Aplodinotus greuniens*)	45	36	6	19	14
Flathead Catfish (*Pylodictus olivaris*)	7	13	17	22	3
Bluegill (*Lepomis macrochirus*)	9	7	4	37	0
Channel catfish (*Ictalurus punctatus*)	7	5	2	3	1

The CPUE did not differ significantly between sampling periods for the other eight abundant species in the hoop net catches, but some trends in total catch were noticeable. Flathead catfish and bluegill had catch patterns similar to those of black crappie with highest flow and turbidity. Hubert and Schmitt (1982) found turbidity to have a positive influence on CPUE of flathead catfish. Their regression analysis for bluegills showed both turbidity and current velocity account for significant variability in CPUE; however, the influence of turbidity on CPUE was negative, whereas that of current velocity was positive. An additional species, quillback, also showed evidence of being influenced by turbidity, the catch being lowest during a period of high turbidity. Hubert and Schmitt (1982) reported that turbidity accounted for significant variation in CPUE of quillback.

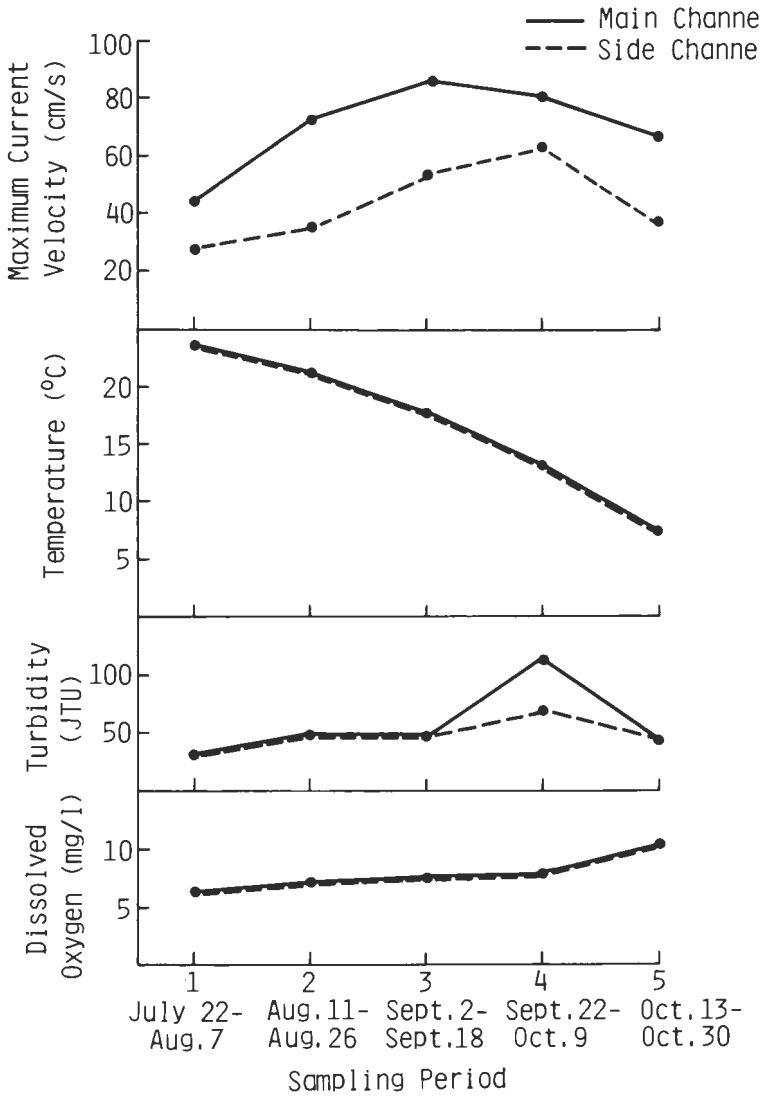

Figure 1. Mean values for environmental variables measured in main-channel and side-channel habitats of Pool 9, Upper Mississippi River, for each of five sampling periods. 1980. (Adopted from Hubert and Schmitt, 1982.)

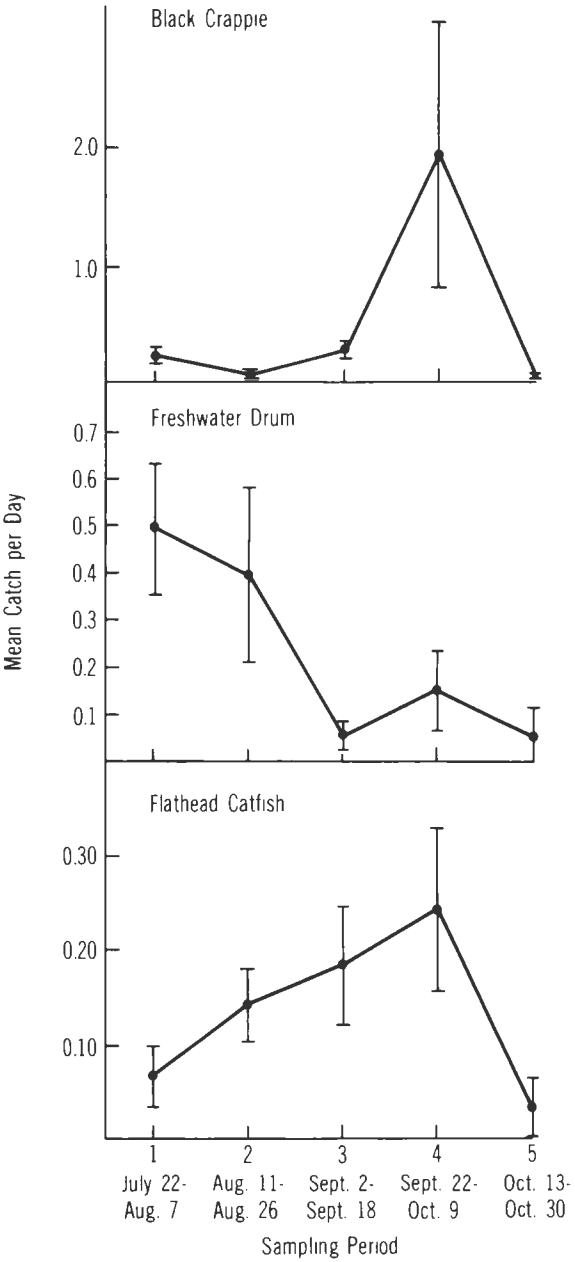

Figure 2. Mean catch per net day in bait nets of the three species showing statistically significant variation over the five time periods of the summer and fall, 1980. Vertical lines show one standard error on either side of the mean.

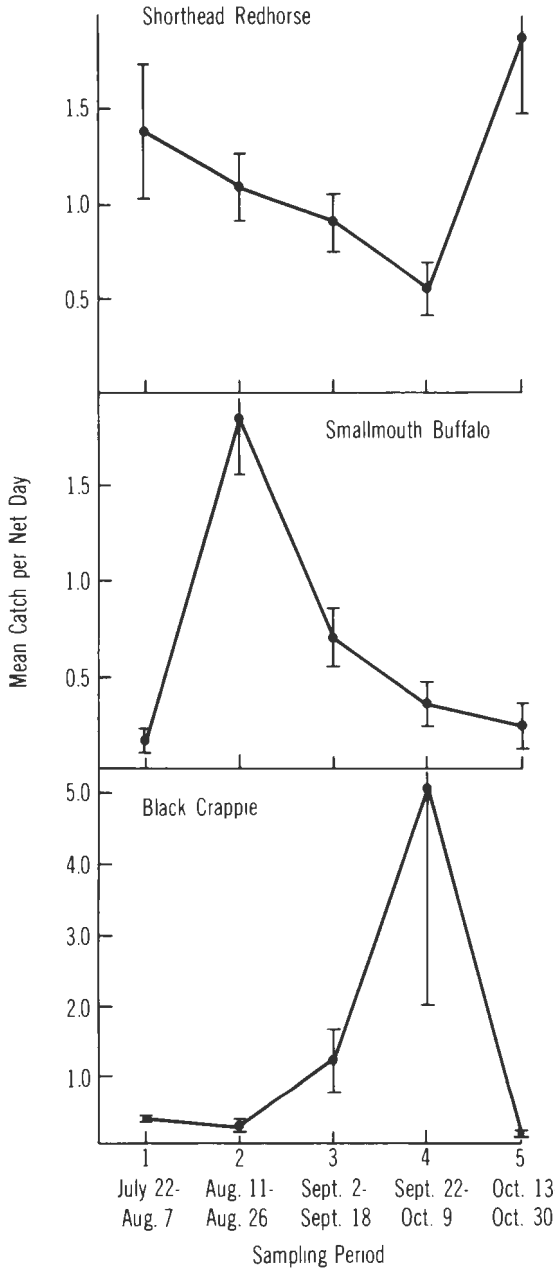

Figure 3. Mean catch per net day in buffalo nets of the three species showing statistically significant variation over the five time periods of the summer and fall, 1980. Vertical lines show one standard error on either side of the mean.

Four species, in addition to smallmouth buffalo, showed trends that could be related to changing water temperatures during the study. Catches of channel catfish declined as water temperature fell from about 23° C to 7° C. Mayhew (1973) observed a similar pattern in the Des Moines River, Iowa. The catches of mooneyes, common carp, and walleyes were highest during late October, when water temperature had declined to its lowest point of the study. Hubert and Schmitt (1982) found water temperature to account for significant variation in CPUE of common carp and walleyes. In both species the relationship between CPUE and water temperature was negative.

In general, the catch of several species (shorthead redhorse, black crappie, freshwater drum, flathead catfish, bluegill, and quillback) appeared to be influenced most by unpredictable environmental variables such as current velocity and turbidity. However, the catches of some species (smallmouth buffalo, channel catfish, common carp, walleye) seemed to be primarily associated with seasonal changes in water temperature. It may be possible that control of the sampling period to coincide with specified water temperatures would reduce variability in hoop net catches for some Upper Mississippi River species.

Length Frequencies

Length frequency distributions of fish captured in both bait nets and buffalo nets were computed (Figures 4 and 5). Of the four species most frequently captured in both types of hoop nets, three (black crappie, shorthead redhorse, and bluegill) had similar length frequency distributions, whereas substantially different distributions were observed for freshwater drum.

Hoop nets captured fish over a wide range of sizes. Knowledge of total length of a species when it becomes fully vulnerable to the gear is particularly useful in interpreting monitoring data. For several species, recruitment to the gear appeared to occur at a larger than the minimum size at which fish would be held by the net mesh—possibly partly due to habitat selection and movement tendencies of riverine fish. For example, relatively large crappies and bluegills were captured by the hoop nets in channel habitats. Probably the larger centrarchids frequent flowing channel habitats and smaller ones tend to be more confined to sloughs and backwaters.

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We thank John Verdon and William Noonan for their assistance in the field; the Iowa State Conservation Commission—in particular

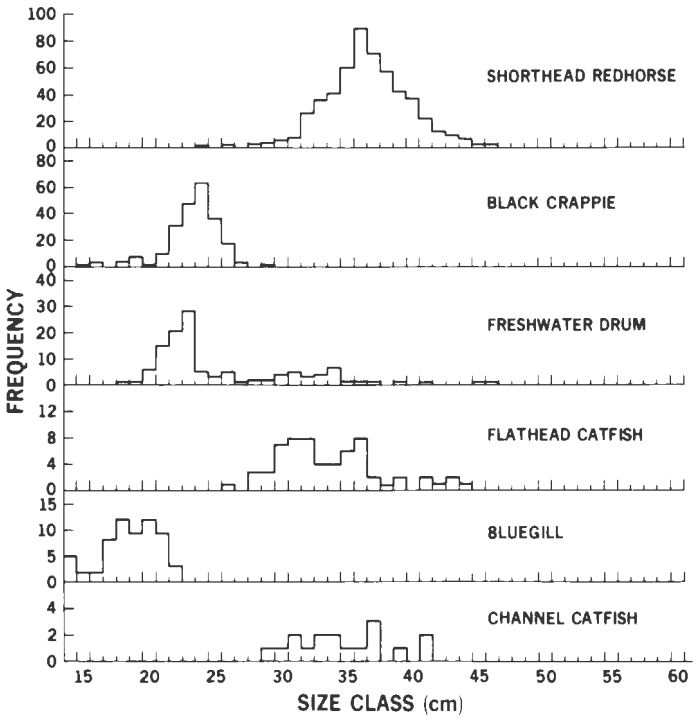

Figure 4. Length-frequency distributions of the six most abundant species captured in bait nets from Pool 9, Upper Mississippi River, July-October 1980.

John Spinner—for facilities, equipment, and guidance; and Kenneth Carlander and John Nickum for reading the manuscript and making suggestions.

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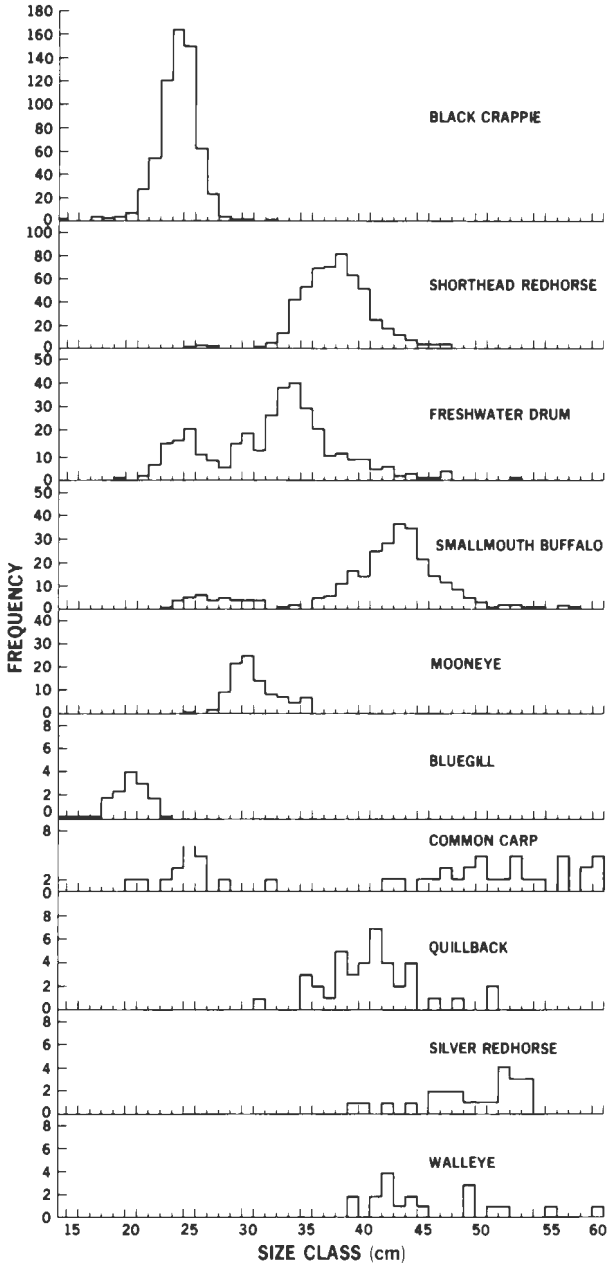

Figure 5. Length-frequency distributions of the 10 most abundant species captured in buffalo nets from Pool 9, Upper Mississippi River, July-October, 1980.

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THE IOWA STATE UNIVERSITY STUDENT-MANAGED AG 450 FARM: A HISTORY[1]

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ABSTRACT. The Ag 450 Farm is an Iowa State University student-managed teaching farm which, since 1943, has provided a unique environment for students to learn farm management and decision-making skills. In addition, the Ag 450 Farm is a self-supporting business entity within the University's farm structure. The Ag 450 course bridges several agricultural disciplines, including animal science, agronomy, agricultural mechanization and engineering, and agricultural economics.

Various historical characteristics of Ag 450 are explored, including the formation of the course, the beginning of the farm, the purpose and organization of Ag 450, the instructiors, the Ag 450 field days, student farm labor, and the Ag 450 Farm's crop and livestock production history.

Ag 450 is unique among college agricultural course work. Apparently no other class possesses the distinct Ag 450 characteristic: student management of a self-supporting farm business.

Index descriptors: farm management, land laboratory, teaching farm, production agriculture, decision making, Farm Operation curriculum, school farm, corn production, swine production, cattle production.

INTRODUCTION

In the "people's college" tradition of its beginnings, Iowa State University has long played a leading role in agricultural instruction. Since World War II, the widespread application of science to production agriculture has placed additional value on higher education for farmers and agribusinessmen. The Agricultural Studies 450 course (known as Ag 450), in which students experience applied farm management, was first taught in 1943 at Iowa State University. The farm has since been called the Ag 450 Farm.

The class consists primarily of junior and senior undergraduates majoring in curricula focusing on production agriculture. These curicula include Agricultural Business, Agricultural Education,

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Agricultural Mechanization, Agronomy, Animal Science, and Farm Operation. A majority of the students have Iowa farm backgrounds and are interested in farming or jobs closely associated with farming for their careers.

Since its inception, the class has been required to make all of the management decisions. Committees explore decision alternatives and present recommendations to the class. The class discusses the recommendations and determines appropriate action by majority vote. Therefore, Ag 450 is a unique course in applied farm management.

This account of Ag 450 is based on data derived from (1) interviews with former Ag 450 instructors, (2) the Ag 450 farm file in the Special Collections of the Iowa State Library, (3) reviews of published literature on Ag 450, (4) the current working files of Ag 450, and (5) the author's personal experience as instructor of Ag 450 from 1980 to 1984. Further detail and documentation are provided in the author's thesis (1983).

FORMATION OF AG 450 COURSE

In 1933, a committee representing several agricultural disciplines of the then Iowa State College of Agriculture and Mechanic Arts issued a report entitled "A Statement of Objectives for Agriculture." The report's section on education stated, "Training for farming should develop maximum efficiency in the production and marketing of agricultural products and also *skill in the actual management of the farming business, taken as a whole*" (Committee on Agriculture Philosophy and Objectives of the Iowa State College, 1933 [italics added]). The report was approved unanimously by the agricultural faculty.

A few years later, a young economics professor, William B. Murray, at Iowa State College grappled with the problem of how to teach students farm management. He stated his views as follows (Murray, 1938):

> The chief difficulty with farm management teaching is finding a way to teach a young man how to manage a farm. Textbooks on the subject as well as teaching methods are generally weak on how to operate a farm. . . . What we need in training the prospective farm manager is something entirely different.

Murray described his "slightly different approach" with three suggestions, "(1) emphasizing vital farm management decisions, (2) linking of class discussions with laboratory farms, and (3) having students discuss their recommendations for laboratory farms with the operators of these farms." He further stated:

> Not enough emphasis is being placed on important decisions the farm manager has to make. As it usually happens in teaching, the manager's decisions are tackled indirectly; and only those decisions for which ample data are available. In essence, however, farm management is a matter of decisions, the decision itself being the focusing point and the data relating to it a supplementary factor (Murray, 1938).

Some of the vital decisions facing a young farmer then and now include what to produce, the size of the farm, whether to buy or rent land, and the details of the farm's crop and livestock system. According to Murray, such decisions facing a farmer represented "the heart of farm management."

To implement his views at Iowa State College, Murray proposed using laboratory farms linked to the classroom, where the students could prepare recommendations for discussion by the class and the laboratory farm operator. He obtained an official forum for his views when appointed to the Agriculture College Curriculum Committee in the fall of 1941. The committee, chaired by Dr. J.A. Starrak from agricultural education, included Murray and representatives from animal husbandry, agronomy, and agricultural engineering. The eventual outcome of the committee's discussions was the Ag 450 course, which began in January 1943, and subsequently, establishment of a curriculum in farm operation which began in 1944 (Starrak, 1944; Interview, Murray, 1983). The Ag 450 course specifically addressed the area of farm management decision making. The Farm Operation curriculum blended coursework in the areas of crop and animal production, and agricultural business.

In planning the administrative affiliation of Ag 450, the question arose whether the student farm should be set up as part of the farm management section in the economics department. The answer was "no," because economists had little interest in livestock breeding, crop production, or other such topics important to farm operation (Murray, interview, 1983).

Therefore, the Ag 450 course and farm were initally administered from the office of the Dean of Agriculture. Later, it became part of the Farm Operation curriculum. Thus it would then serve all departments and show that "all subject matter phases have a chance for expression just as they do on a typical farm" (Murray, 1945; Iowa State College, 1943).

BEGINNINGS OF AG 450 FARM

In 1942, the college administration was asked to provide a farm to be used as "teaching equipment, in the same category as microscopes, dairy manufacturing equipment, agricultural machinery and livestock" (Murray, 1945). Not unnaturally, Murray was named as the initial instructor.

The 187-acre farm selected, south of campus about three miles, was purchased in 1942 for $150 per acre, for a total cost of $28,000. The buildings on the farm included a barn, corn cribs, a house, and out-buildings. Most of the buildings were adequate for use except the house which was in very poor condition (College of Agriculture, 1978).

In the fall of 1942, three students worked with Murray making plans for the actual farming operation which was to begin the following spring. Some gilts were purchased by these students in preparation for moving to the farm (Murray, 1945).

Winter Quarter 1943 was the first class of Ag 450. This class was occupied with hiring a herdsman, making crop plans, and buying more gilts and a team of mules. On March 1, 1943, the class took possession of the farm. Mr. Roy Picht, the herdsman, moved into the house. The class negotiated his salary at $75 per month with milk and eggs provided. A corn-corn-oat-meadow rotation was planned. Livestock included several bred gilts and a team of mules, with plans to add dairy cattle and chickens when warmer weather permitted (Murray, 1945; College of Agriculture, 1978).

PURPOSE OF AG 450

After teaching seven classes of Ag 450, Murray was sure the purpose of the course was to give the students experience in decision making. He noted:

> By all odds the outstanding principle in the course is that success is obtained in direct proportion as the students are given definite responsibility and allowed to make important decisions. . . . And before graduating from college a student

> expecting to operate a farm should have a working knowledge or training in at least four fields, first the farm practices of his area, second the scientific principles of crop and animal production including the use of power and equipment, third the business principles of farming, and finally the making of management decisions. The student may have covered the first field in part before he comes to college. The second and third fields he has a good chance to cover in college but the fourth field of decisions is one in which he has at present little opportunity to obtain training while in college (Murray, 1945).

In 1953, the course description of Ag 450 stated that the students participate in the management and operation of an Iowa farm and are responsible for the plans, records, and decisions of buying and selling of the livestock, crops, and equipment of the farm (Iowa State Catalog, 1953). The course description has remained unchanged since that time (Iowa State University, General Catalog, 1983).

In 1949, A.T. Odegaard surveyed 252 former students of Ag 450 who had been enrolled during the period 1943-48. These students were asked to rate 17 statements describing Ag 450. The top four rated statements were (Odegaard, 1949):

1) Training in accomplishing cooperative work with others.
2) Opportunities to make decisions in farm management.
3) Training in obtaining and using information as a basis for making decisions.
4) Opportunities to secure understanding of over-all problems in farm management.

The process of making decisions stretched the students' knowledge base. Former instructor J.J. Wallace (1963) noted that, "One by-product of this course is an indication to each participating student of a need for additional study and education. Not until a person is up against the hard realities of making a decision does he become aware of his shortcomings." Managing the farm stimulated the students to apply their knowledge and seek new information.

The students made decisions in a group setting with each student having the opportunity to listen and contribute to the discussion. The students practiced speaking, logic, discussion, questioning, and listening.

P.O. Gibson (Interview, 1983) described this group process as "the give and take necessary to get an idea accepted by the rest of the class members." Not only did the student learn to follow the decision-making process, but he had to justify his plan to the class for discussion and approval.

During the discussions, students often learned from each other. New ideas and original approaches were gained through interaction with those of differing backgrounds or experiences. Frequently students often came to know their Ag 450 classmates better than those in any other college course.

ORGANIZATION OF AG 450

In Ag 450, decisions have been and are made by the entire class. The students have responsibility for their own meetings. Committees consisting of three to five students are selected to study and report on the various farm projects. The committees are organized according to enterprises such as corn, swine, beef, and resources, i.e., land, labor, or problem areas. At times, the students are rotated between committees to permit them to serve on more than one committee during the academic term . These committees operate with little instructor or faculty input unless it is requested. The Ag 450 committee system has been used almost continuously for 40 years as the major framework of the class (College of Agriculture, 1978).

Officers (chairman, secretary, treasurer, etc.) are elected by the students. Although the titles and the number of officers have changed according to the students' preference, the number of officers has generally increased with time. Currently, there are ten.

Because Ag 450 emphasizes student participation, grading has posed a unique problem for the instructors. The evaluation of oral and written reports justifying the students' decisions has been a major part of the students' grade. Since 1950, a rating system in which students grade the other members of the class on their class performance has also been incorporated into the student's final grade. (Interviews, 1983).

There has been considerable discussion regarding the credit and duration of the Ag 450 course. Murray (1945) stated that it would be desirable to give the students contact with the farm for an entire year with fewer credits each quarter. Odegaard (1949) reported that 62% of former students (1943-1948) thought Ag 450 would be improved by increasing the length of the course from one quarter to three or more quarters and reducing it from three credits to one credit per quarter.

Table 1. Ag 450 instructors.

Years	Instructor	Field
1943-1944	W.G. Murray	Agricultural Economics
1944-1949[a]	J.M. (Milt) Holcomb	Agricultural Education
1947-1950	A.T. (Alf) Odegaard	Agricultural Education
1950[b]	L.M. Thompson	Agronomy
1950-1951	S.K. (Ken) Oakleaf	Agricultural Economics
1951-1954	Robert L. Skinner	Animal Science
1954-1965[c]	J.J. Wallace and J.L. (Jack) Alexander	Agricultural Economics Agricultural Economics
1966-1969	Neil Patrick	Agricultural Economics
1969-1970[d]	Philip Gibson	Agricultural Economics
1971-1974[d]	Dale Weber	Animal Science
1974-1976	J.L. (Jack) Alexander	Agricultural Economics
1976-1977	L. Craig Harris	Agricultural Economics
1977-1980	Ronald J. Herr	Agricultural Economics
1980-[d]	Mark S. Honeyman	Animal Science

[a]In 1948 and 1949, two classes of Ag 450 were offered on two separate farms with two instructors.

[b]L.M. Thompson taught Ag 450 for a short time in 1950 prior to S.K. Oakleaf and was responsible for the farm in 1951 prior to R.L. Skinner. At that time, L.M. Thompson was professor-in-charge of Farm Operation curriculum.

[c]From 1954 through 1965, J.J. Wallace and J.L. Alexander shared teaching responsibilities of Ag 450. Wallace taught some quarters and Alexander taught others. They also managed the Iowa State Foundation Farms.

[d]Instructors who had been enrolled in Ag 450 as undergraduates.

J.J. Wallace (1963) stated that the most serious criticism of Ag 450 was that "students were not in contact with the course long enough to accept the consequences of the decisions made by their class." Wallace felt that this was a valid criticism, but the term 'long enough' was a relative one. Surely 12 months would be better than three months and five years better than one year. Wallace concluded that "the optimum answer to the problem of how much time is needed (for Ag 450) is yet to be solved under our academic system." Obviously the duration and credit of Ag 450 are at least partially defined by the structure of the academic system.

THE INSTRUCTORS

Ag 450 instructors have come from a variety of agricultural disciplines, including agricultural economics, agricultural education, agronomy, and animal science. Table 1 lists the instructors, their discipline or field, and their tenure of teaching Ag 450.

The role of the instructor in the Ag 450 course is necessarily atypical. Former instructors viewed their position and responsibility in a variety of ways. For example, Murray (1945) described the Ag 450 instructor as a "combination auditor and board chairman, leaving all the initiative for action with the students." Odegaard (1949) stated that, "In order to make the management of the Ag 450 farm the responsibility of the students . . . instructors have attempted to withhold their opinions during the discussion of management problems."

Weber (Interview, 1983) viewing the instructor's role as advisory said:

> I tried to be as quiet as I could during class meetings. I tried very hard not to dominate the conversation. If an instructor became domineering, students lost interest. I wanted the students to express themselves and to make decisions without the instructor's influence.

With classes changing quarterly, the instructor gave the class vital background information of the farm and on the decisions of prior classes. He provided history and continuity by serving as a resource person to the students and was the interim farm manager between classes (Interviews, Skinner, Alexander, Gibson, 1983).

This passive instruction required a certain style of teaching. Wallace (1963) described it in this way:

> The instructor must be adept at teaching how to properly approach management decisions without unduly influencing the decision. Unless he maintains constant vigilance toward making sure that the principles of production economics are recognized and applied, the course can degenerate into a day-to-day application of production technology. One of his (the instructor's) most difficult, but most important, tasks is to refrain from making management decisions. Rather, he must act as a side-line coach making sure the management function is carried out (by the students).

Thus the instructor walked a narrow path. He taught the students how to make decisions, but he could not make decisions for them. He taught farm management, yet he had to wait for the students to manage the farm. He became an expert on the Ag 450 Farm, but the students were the managers. He stimulated the students to manage, decide, and experiment, while requiring that they have sound justification for their decisions. He instructed the students in the processes of decision making but had to let them make mistakes. Murray (1945) summed it up in this way:

> Whenever the instructor indicates his preference, tells the students what they ought to do, or takes over any responsibility, the students lose interest. There is no half-way solution, either the farm is run by the students or by the instructor. If the instructor takes the responsibility then the students fail to get the training in making decisions.

FIELD DAYS

"Keeping the student in touch with the farm after he has finished the course is an important and worthwhile task," stated Murray (1945). Farm tours and newsletters are and have been used to show former students the results of their decisions. The farm tours have been called: "Ag 450 Open House," "Ag 450 Field Day," "Ag 450 Clinic," and "Ag 450 Progress Tour." The farm tours are planned and conducted by the students enrolled in the course. They were held on an annual basis from 1954 through 1967 and intermittently prior to and following that period. They have served as a reunion for former class members. Faculty and extension staff are frequently invited. At one time, the former students were surveyed for agricultural questions to be answered at the farm tour by a panel of extension specialists. Central to the tours are the students. The current class conducts the tours and former students reminisce and observe the outcome of their decisions (College of Agriculture, 1978).

STUDENT FARM LABOR

Should Ag 450 students also be required to work on the farm? Because most students already had experience with manual farm labor, and because farm work was not deemed crucial to learning farm management, the response generally has been negative. Even though some urban students need experience with down-to-earth

farm work, the use of Ag 450 to teach such skills had been resisted because it was feared that the emphasis on decision making would be lost (Interview, Murray, 1983).

Nevertheless, several work-decision making combinations have been tried. Wallace (1963) reported that students were paid when they volunteered to work on the farm. A distinction, then, was made between paid physical labor on the farm by students and unpaid committee work on the farm, the latter being part of the students' management function. Alexander confirmed this and cautioned that this arrangement is easy to abuse (Interview, 1983). In the 1970s, the Ag 450 students were required to perform livestock chores for which they were paid. Weber (Interview, 1983) stated that there was "real value in the students having to get out there on the farm."

Beginning in 1981 in an effort to refocus Ag 450 on farm management, Ag 450 students have not been paid wages for work performed on the farm. This eliminated the indefinite division between paid physical labor and unpaid managerial on-farm activities. The Ag 450 class now hires other students to work on the farm, which has created opportunities for the class to gain skills in employee interviewing and evaluation. Ag 450 students are required to spend eight hours on the farm early in the semester to become familiar with the farm (College of Agriculture, 1983).

Incidental to discussions of student labor, the establishment of a student dormitory on the farm has been considered. It has not come about.

THE AG 450 FARM OPERATION

From the beginning, the farm was designed to be self-supporting. Murray (Interview, 1983) stated that if the student-managed farm was not profitable, it might be desirable to examine the agricultural instruction at Iowa State. According to L.M. Thompson, former professor-in-charge of Farm Operation and Associate Dean of Resident Instruction, College of Agriculture, Ag 450 has received no subsidy from University funds. Thompson (Interview, 1983) continued, "If we can't teach farmers to make money, we have no business teaching farm management."

The Ag 450 Farm has flourished as an independent operation. For example, in 40 years of operation the farm's net worth has grown to nearly one million dollars. While many factors (weather, markets, etc.) contribute to a farm's profitability, over the long term, the student farm managers' decisions have been reflected in the success of their operation.

Land and Improvements

In 1943, the Ag 450 class rented 158 acres from the College at the rate of $10 per acre. The following year and until 1951, the entire 187-acre farm was rented for $12.50 per acre (College of Agriculture, 1978).

In 1951, the class voted to repay the $23,000 farm loan over a fifteen year period. Since that time the class has operated the Ag 450 Farm as owner-operator on a cash basis with only limited use of borrowed capital.

With final payment of the farm loan in 1966 and the initiation of leasing additional land in 1967, the capital base of the Ag 450 Farm was established. The classes moved quickly to make improvements on the Ag 450 farmstead. As shown in Table 2, since 1966 the Ag 450 classes have added numerous structures to the farm. These have been primarily specialized-use structures for grain and forage storage and handling, and swine production.

The farmland was operated as one unit except for two years during the late 1940s, when two classes of Ag 450 were offered. The temporary influx of World War II veterans required that another farm be leased for a second class. (Interviews, Holcomb, and Odegaard, 1983).

Crop Production

From 1943 until 1956, the Ag 450 class hired the field work on a custom basis. Crop rotation followed, as shown in Table 3, was approximately corn-corn-oat-meadow, except for soybeans in 1943-45 and popcorn in 1945. The rotation was followed to maintain soil fertility because use of commercial fertilizer was limited. All the corn was harvested as ear corn during this period. Silage harvesting began in the early 1950s (College of Agriculture, 1978; Interviews, Odegaard, and Skinner, 1983).

The farm was wet, poorly drained, and weedy. Holcomb (interview, 1983) remembered that in 1944 "the farm was so foul with cockleburs you could hardy walk through it." Therefore the farm was among the first to initiate herbicide spraying in an effort to control weeds.

The class purchased its first tractor in 1950; however, it was used in the feeding of livestock and hauling of manure rather than for crops. In 1956, the class began supervising the field work but because of very limited capital, machinery was leased. With the advent of cheap commercial fertilizer, in the early 1960s, the corn-corn-oat-meadow

Table 2. Improvements to the Ag 450 Farm.[a]

Year	Improvement	Cost (if known)
1959	Farm house	Moved from campus
1964	Cattle shed	Free. Moved from National Animal Disease Center Farm
1965	Swine shed	$1,280
1966-67	Four-bin grain system with grain leg 18,000 bushel capacity (remodeled 1971 to add grain dump)	$14,000
1970	Ten-ton scale and livestock handling facility	$1,327
1970	Pole machine shed, 44′ × 60′	$4,337
1973	Concrete stave silo, 18′ ×60′	$7,000
1974	Cargill swine growing and finishing unit	$23,500
1977	Farrowing house, 22 stall	$40,000
1978	Nursery addition to farrowing house, 200 head	$30,500

[a]These improvements are in addition to nearly continuous improvement and expansion of concrete feeding floors, livestock fences, field tile drainage systems, and the farm windbreak since the class assumed management of the farm in 1943 (College of Agriculture, 1978).

rotation was discontinued. Soybeans were added in 1961, and a corn-corn-soybean rotation was achieved in 1967. During the late fifties and sixties, extensive tiling was done on the farm to improve drainage (College of Agriculture, 1978; Interview, Alexander, 1983).

Corn, the principal crop, was utilized primarily for livestock feed. Corn acreages for each year 1944-81 are shown in Figure 1. Soybeans were sold as a cash crop. By the mid-seventies, Ag 450 had acquired a full line of machinery and was involved in an expanded building

Table 3. Ag 450 Farm Crop Enterprises, 1943-1981.[a]

Crop type	Years of enterprises
Corn	1943 to 1981
Soybeans	1943 to 1945, 1961 to 1981
Oats	1943 to 1944, 1946 to 1947, 1949 to 1960, 1962, 1979 to 1980
Pasture	1943 to 1951, 1971 to 1972
Hay	1943 to 1956, 1959, 1966, 1973 to 1974, 1981
Popcorn	1945
Diverted[b]	1965, 1967 to 1972, 1979

[a]Includes crops on owned and rented land.

[b]Land taken out of production as part of government program.

program. Since 1970, commercial fertilizer, insecticides, and herbicides have been used extensively in corn production (Interviews, Gibson, Weber, and Harris, 1983).

Livestock Production

Livestock production has been prominent and diversified on the Ag 450 Farm (Table 4). Farrow-to-finish swine production and beef cattle feeding have been nearly constant. Draft mules or horses were used until 1950 when they were replaced with a tractor. During the

Table 4. Ag 450 Farm Livestock Enterprises, 1943-1981.

Livestock type	Years of enterprise
Poultry	1943-1954
Dairy cows	1943 to 1952
Draft horses or mules	1943 to 1950
Farrow-to-finish hogs	1943 to 1981
Ewe flock	1952 to 1960
Beef cattle feeding	1945, 1947 to 1949, 1950 to 1981

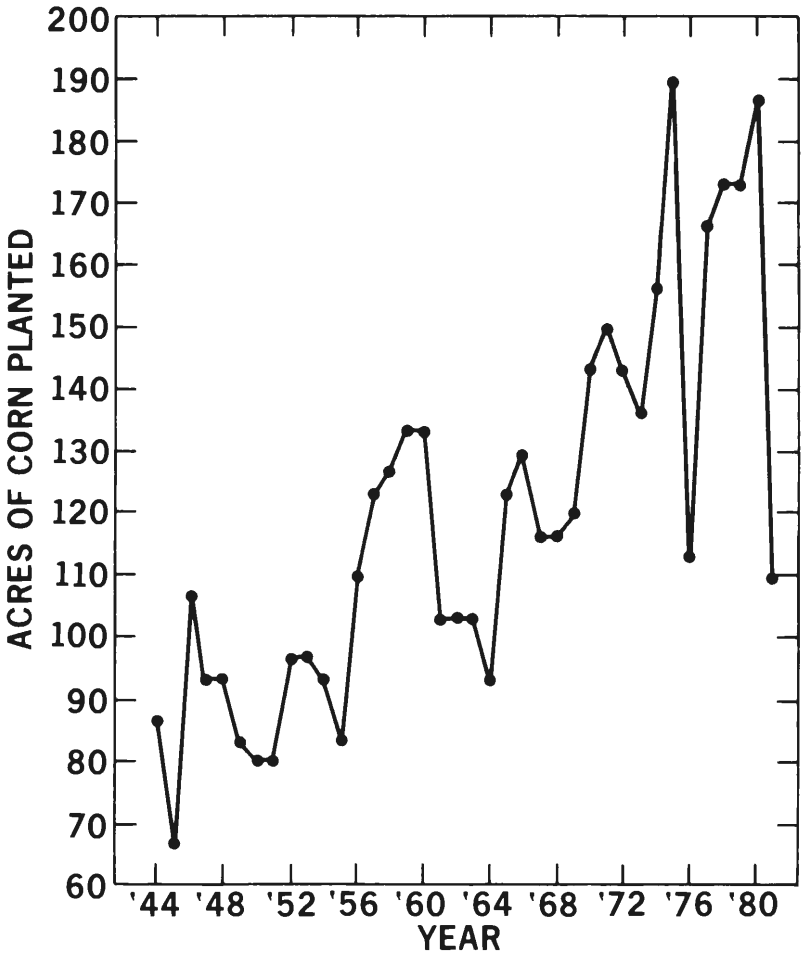

Figure 1. Acres of corn planted by Ag 450, 1944-1981.

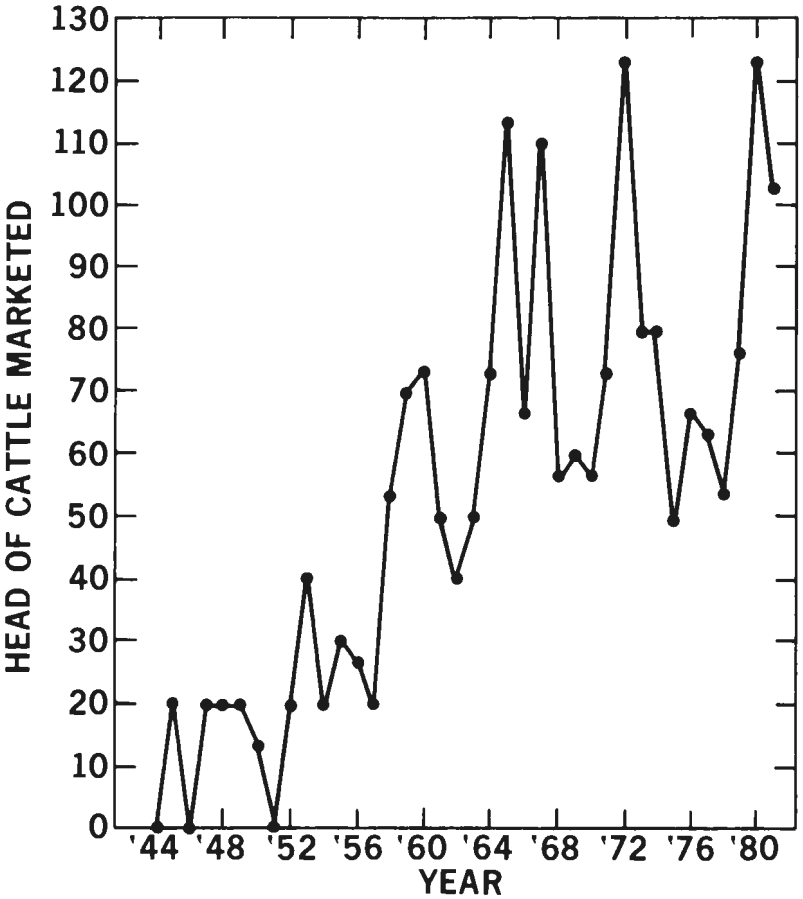

Figure 2. Head of slaughter cattle marketed by Ag 450, 1944-1981.

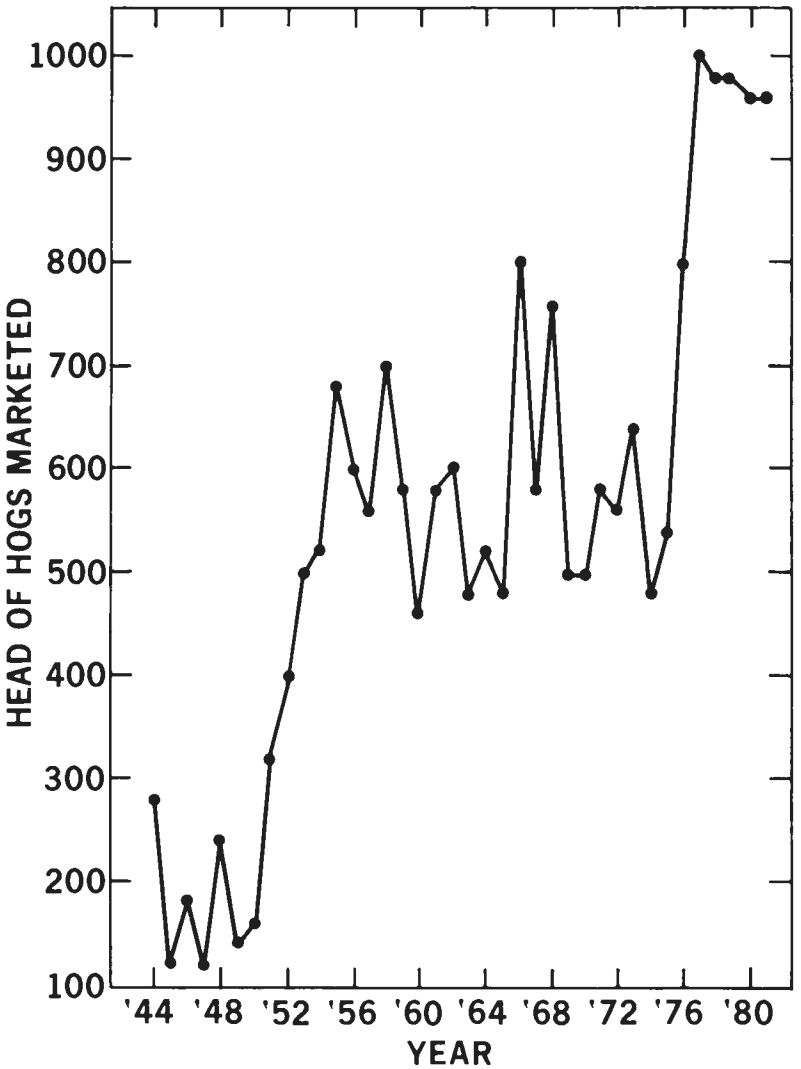

Figure 3. Head of hogs marketed by Ag 450, 1944-1981.

1950s, specialization and intensification in hogs and beef cattle resulted in discontinuing dairying in 1952 and poultry in 1954. A ewe flock was maintained from 1952 until 1961. Feeder lambs were purchased and fed from 1976 to 1978 (College of Agriculture, 1978).

Beef cattle feeding has been nearly a continuous enterprise at the farm utilizing forages, as well as corn, produced on the farm. The number of cattle on feed has been quite variable on the Ag 450 Farm (Figure 2).

The predominant livestock enterprise on the Ag 450 Farm has been swine production. Hogs have been raised on the farm continuously since 1943 in a life-cycle, farrow-to-finish operation. Occasionally a small number of feeder pigs has been sold, but the class has never purchased feeder pigs. Swine production at the Ag 450 Farm has undergone intensification over time (Figure 3).

The first class of students purchased gilts to farrow in March 1943. When asked why these students selected hogs for Ag 450, Murray replied, "because every farm had hogs," and presumably they were profitable on Iowa farms in the 1940s (Interview, 1983).

A pasture system was used in which the hogs were rotated to different fields each year to help control disease and parasites. Farrowing occurred once or twice per year in individual houses on pasture. The class fluctuated between crossbred and straightbred hogs, with a great deal of discussion on the merits of each (Interviews, Holcomb, and Odegaard, 1983).

In the 1950s, farrowing increased to twice or three times yearly using crossbreds in both pasture and central house systems. The farm operator mixed the feed on the farm. The entire corn crop was fed to either the hogs or the cattle. Skinner remembered that, "it was muddy, terribly muddy," at the Ag 450 Farm. To overcome these problems, many of the lots were paved and the empty dairy barn was converted to farrowing stalls (Interviews, Skinner, and Alexander, 1983).

The 1960s brought continued intensification with farrowing increased to four times annually and pasture farrowing discontinued. Crossbreeding was maintained, and all the feed was mixed on the farm (Interview, Alexander, 1983).

During the 1970s, swine production at the Ag 450 farm intensified further. New confinement buildings were constructed to replace inadequate facilities, expand hog production, and utilize the latest swine confinement design. Farrowing was increased to six times per year and weaning age was reduced from eight to six weeks. A rotational crossbreeding program was implemented which utilized a sow indexing system to identify the top producing sows.

AG 450: A UNIQUE SITUATION

In the array of educational opportunities for agricultural students, Ag 450 offers an unduplicated experience. A review of major land grant university catalogs found no similar farm management course. Numerous courses utilized case studies, field trips, computer simulation, or supervised work experience, but none centered around student management of an on-going farm business for profit. In interviews with former instructors and administrators no teaching farm organized like Ag 450 was known (Interviews, 1983). A review of literature on teaching farms and land laboratories revealed no comparable university course.

The Ag 450 Farm has evolved from countless decisions by numerous groups of students. The farm activities reflect the students' experiences in the classroom and on their home farms. The farm has endured, flourished, and kept pace with progressive corn belt technology.

Frequently, the subject matter of various disciplines is used in the problem-solving process. When mistakes are made, they are the responsibility of the students. This focuses the accumulation of knowledge and experience at the student level. Learning to make decisions using one's education is valuable. Ag 450 exemplifies participatory education in agriculture management.

Rarely are students allowed to manipulate an operating business for credit. In the Ag 450 educational simulation, learning is practical, unstructured, and applied in nature. One true test of education is in its application; in Ag 450, that application is in the decision-making process. Ag 450 has worked well at Iowa State University. The realism of a self-supporting farm business with the management responsibility focused at the student level has distinguished this unique program since its inception.

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APPLICATION OF FREEZE-MARKING TO WILDLIFE IN THE FIELD: PRAIRE DOGS[1]

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ABSTRACT. A pressurized refrigerant (Quick-Freeze) was used to freeze-mark 17 black-tailed prairie dogs (*Cynomys ludovicianus*) to assess its application for permanently marking wildlife in the field. The refrigerant was applied directly to the animal's flank and hip through a plastic stencil without anesthetizing animal or body-site. Treatments an average of 3.6 sec resulted in no hair loss or white hair growth; at ca.7 sec, a poorly visible mixture of white hair and pigmented hair; at 13 sec, moderately visible white hair; at ca.19 sec, optimally marked; at 25 sec excessive tissue damage resulted. Recommendations are made for application of this technique to other wildlife species.

Index descriptors: Freeze-marking, hair development, prairie dogs, refrigerant, wildlife.

INTRODUCTION

Permanent marking of animals for later identification is important in field studies of wildlife. Ideally, animal identification techniques should cause minimal pain, little or no skin and tissue damage, and produce a permanent mark visible from a distance.

Usual methods for animal marking include ear-tagging, toe-clipping, leg-ringing, neck-collaring, hair clipping and dyeing, and hot-iron branding (Schemnitz 1980). Each method has disadvantages. The first four do not allow for individual identification at a distance; tags and collars sometimes catch and pull off or result in injury; hair-clipping and dyeing last only until the next molt; and hot-iron branding, though permanent, causes pain to the animal and injury to the skin.

Survival of mammalian tissue after freezing was reported early in this century by Michaelis (1905) and Klinke (1939). Taylor (1949) in studies on rats, found that surface freezing killed pigment-producing melanocytes in the hair follicles, resulting in the development and growth of white hair at the frozen site.

Freeze-marking procedures have been tested by several investigators: Farrell and Johnson (1973) on dogs; Lazarus and Rowe (1975)

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on mice, rats, and coypus; and Rood (1980) on mongooses. Most of the animals marked in previous studies were either livestock or experimental animals kept in captivity. Few efforts have been made to freeze-mark wildlife species; those that have done so either used bulky equipment, anesthetized the animals, and/or clipped their hair.

We attempted to apply a more simple and rapid method to permanently mark wildlife in the field without the need to anesthetize the animals or clip hair. Black-tailed prairie dogs (*Cynomys ludovicianus*) were selected because they are easily trapped and observed in their open-prairie habitat (see Koford 1978). Our objectives were to: 1) apply the technique under field conditions, and 2) define the most suitable body-site for marking and optimum timing for applying refrigerant.

MATERIALS AND METHODS

The refrigerant used in this study was a canned, pressurized spray called Quick-Freeze (Miller Stephenson Chemical Company, Danbury, CT. 06910) and labeled as freezing to −45 C. In preliminary tests, using two captive prairie dogs, the spray was applied directly to the skin on the side (rib cage) for 2 to 15 sec each. A plastic homemade stencil (7 × 1.5 × 5 cm) was used in applying the refrigerant to prevent overspraying beyond the desired mark. The hair was clipped, at the pertinent body-site with scissors and the area irritated with a stiff toothbrush before the refrigerant was applied to determine if dark hair might develop instead of white hair as suggested by Farrell et al. (1966).

In June 1981, at Wind Cave National Park, South Dakota, the same side/flank freeze-marking technique (without hair-clipping) was applied to 17 free-ranging prairie dogs (15 of which were later relocated). Application time ranged from 3 to 25 sec. Using a black cloth bag to avoid getting bitten, two people were required to handle the animal, and spray the body-site. All treated animals were fur dyed and ear tagged for the purpose of identification until white marks developed. Animals were aged according to Garrett (1982). Marked animals were observed from a distance, retrapped, and examined monthly for five months to assess changes in the hair and skin conditions. A final remote observation was made 13 months after marking.

Two months after application, we categorized the resulting freeze marks in to five groups depending upon the amount of change: 0 = No Change (no hair loss nor unpigmented hair developed), 1 = Poor (little unpigmented hair developed), 2 = Irregular (a mixture

of pigmented and unpigmented hair developed), 3 = Moderate (a mark of unpigmented hair developed, but smaller than the area sprayed), 4 = Optimum (a full mark formed by a thick growth of unpigmented hair), and 5 = Excessive (permanent hair loss and only a small amount of white hair developed).

RESULTS AND DISCUSSION

Refrigerant caused instant freezing of the skin, which thawed after a few minutes, loss of hair in 3 to 5 weeks, and, when it occurred, development of unpigmented hair in 6 to 8 weeks. For treatments longer than 10 sec, scars of various size formed in the middle of the marked site and persisted for about 2 months. Application to the hip for more than 20 sec caused severe stiffening of the hindleg for about 5 min and limping for a few hours before recovery. No dark hair developed as a consequence of clipping hair and irritating the skin prior to application of the refrigerant.

The mean duration of freezing time for the five categories of hair change was a follows (see Table 1): No Change-3.6 sec ($n = 5$, s.d. = 1.3); Poor-6.9 sec ($n = 7$, s.d. = 1.4); Irregular-10.1 sec ($n = 8$, s.d. = 1.7; Moderate-13.0 sec ($n = 2$, s.d. = 2.8); Optimum-18.8 sec ($n = 5$, s.d. = 1.8); and Excessive-25 sec ($n = 1$). Significant differences in freezing time existed between categories ($F = 66.23$, $P < 0.0001$). Furthermore, the protected LSD multiple comparisons procedure (Snedecor and Cochran, 1967: 234) revealed that each category mean was different from all the others ($P < 0.05$).

Our procedure was easy to apply under field conditions. A can of refrigerant, stopwatch, cloth bag to hold prairie dogs, and a small stencil were the only items needed. Optimum marks were highly visible and easily read on the light body coloration of prairie dogs. In contrast, freeze-marking with liquid nitrogen or solid CO_2 require the transport of bulky equipment, rapid sublimation of dry ice, and careful handling of dangerous explosives (Farrell et al., 1966). Necessary anesthetization and hair clipping require much greater handling and time.

Observations of free ranging, freeze-marked prairie dogs over several months revealed no obvious changes in their movement, feeding, or social status. Animal No. 13, who received the maximum treatment on hip and side (25 and 17 sec respectively), was a dominant male in one coterie (family group) before and after freeze marking.

Table 1. Results of freeze-marking black-tailed prairie dogs 8 weeks after application: 0 = No Visible Change, 1 = Poor, 2 = Irregular, 3 = Moderate, 4 = Optimal, 5 = Excessive.

Animal Number	Estimated Age (yrs)	Freezing Time (sec)		Results
		Hip (H)	Side (S)	
1	2	2	8	H = 0, S = 1
2	2	10	5	H = 2, S = 1
3	1	3	5	H = 0, F = 0
4	1	5	3	H = 1, S = 0
5	2	15	10	Animal not relocated
6	1	7	5	H = 1, S = 0
7	1	10	7	H = 2, S = 1
8	1	12	12	H = 2, S = 2
9	2	20	15	H = 4, S = 3
10	1	8	8	H = 2, S = 2
11	1	12	8	H = 2, S = 1
12	2	17	8	H = 4, S = a
13	3	25	17	H = 5, S = 4
14	2	21	11	H = 4, S = 3
15	1	19	9	H = 4, S = 2
16	1	13	13	Animal not relocated
17	1	14	14	Animal not relocated

OBSERVATIONS AND CONCLUSIONS

1. Dry freeze-marking can be applied in the field with canned, pressurized refrigerant, without clipping hair or anesthetizing the animal.

2. A fur dye special pattern worked will as a temporary marker making interim observation possible until the permanent white brand developed (six to eight weeks).

3. A homemade stencil of different shapes helped prevent over-spraying the boundaries of the required mark.

4. Freeze-marking the hip of the animal was preferred over the side because it was more visible and it was applied to a muscular area away from vital organs.

5. Optimum freezing time to permanently mark prairie dogs was from 17 to 19 sec.

6. Further work is needed to determine if a permanent marking technique could be applied to light-colored animals i.e., to ascertain the feasibility of producing dark-pigmented hair instead of white hair.

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USE OF HEATING DEGREE DAYS IN EVALUATION OF HOUSEHOLD NATURAL GAS CONSUMPTION TRENDS[1]

R.E. Carlson, E.S. Takle, and F.P. DeLuca[2]

ABSTRACT. In recent years, spiraling costs of fossil fuels have spawned conservation attempts of many sorts by individual homeowners. We have assembled from three quite different households a unique data set comprised of monthly heating degree days and natural gas consumption records covering a continuous 12-year period. It includes the "before" and "after" fossil fuel price spiral. Regression analyses were used to compare usage patterns over this time period for each winter heating season. Natural gas consumption patterns were significantly related to heating degree days. Different consumption patterns were identified within these three households by examining changes over time in the slope (b_1) and the intercept (b_0) terms of these regression equations. The methods of analyses presented illustrate how consumption patterns for any household can be related to heating degree days. Thus, interested consumers can easily examine their own natural gas usage patterns.

Index descriptors: Energy conservation, Iowa winter weather, temperature indices, HDD (heating degree days).

Heating degree days (HDD) constitute a common thermal index used by utility industries to estimate the amount of natural gas needed for space heating during each winter heating season. The index was established in 1927 by the American Gas Association. On a daily basis, it is the postive difference between a selected base temperature, commonly 65°F, and the average daily temperature (Huschke, 1970). It is presumed that when the mean air temperature falls below the base temperature, space heating is required and fuel consumption begins. It has been argued that because of recent conservation efforts, a lower base temperature should be used. However, for continuity, the 65°F base remains in common use.

Clearly, the day-to-day heating requirements for any household are determined by several physiological, sociological, and meteorological

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variables, including HDD, solar radiation, and wind speed. In the northeastern United States, regression analyses indicated that HDD accounted for the major share of the variation in gas consumption, but inclusion of other meteorological variables provided increased precision. Dare (1981) used both accumulated standard HDD and modified HDD in a regional study of the intensity of the winters of 1976-77 and 1977-78. In that study, the modified form of wind-chill temperature as formulated by Siple and Passel (1945) was used. Dare (1981) concluded that accumulated standard HDD and modified HDD both reasonably quantified the severity of a winter.

Ayres (1977) did not achieve significant correlations of energy consumption with HDD and believed this must be due to the inherent weakness of data based on outside air dry bulb variations only. In fact, the heat-loss index proposed by LeDuc and Won (1979) incorporates solar radiation, temperature, wind and cloud-cover effects. Meyer and Benjamini (1977) stated that simple statistical analysis could be a useful tool for developing, testing, and monitoring policy programs designed to reduce the residential demand for energy. They proposed a "modified degree day" index based on a two-parameter model. It includes a reference temperature reflecting the internal temperature and free heat contribution, plus a slope term accounting for the thermal behavior of the dwelling. This model was successfully tested, and it compared favorably to standard HDD under a number of household energy-use scenarios.

During the decade of the seventies and continuing to today, household energy conservation efforts have been implemented by consumers to combat the rising prices of utilities. Consumers have attempted to slow this cost spiral by reducing consumption where possible. This has included lowering thermostats, adding extra insulation, changing life styles, using alternative fuels, such as wood or coal, or adding solar panels. Numerous other conservation activities could be cited. This has been a difficult period for low income individuals, especially for the elderly, who commonly may be more sensitive to cold temperatures.

As prices fluctuate and the severity of winter weather changes from year to year, it is difficult to evaluate conservation efforts for individual households. For example, the effectiveness of additional insulation would be difficult to evaluate if it were followed by a more severe winter and rising costs of fuel. A more accurate method for evaluating heat conservation efforts requires various types of data extending over several years. Therefore, we assembled 12 consecutive years of natural gas consumption and cost records from our individual

three households, and calculated HDD (Local Climatological Data, Monthly Summary, 1971-83) for each monthly billing over this 12-year period.

Before the results are discussed, it is pertinent to examine HDD normals for central Iowa as given in Table 1 (Climatology of the U.S., No. 81, 1982). The data indicate that over 50% of the HDD accumulate during December through February, with little accumulation during June, July, and August. For this reason, the months of June, July, and August are excluded in the following analyses. The September to May accumulated HDD totals for this study period are listed in Table 2 for Household #1. The data indicate that the 1977-78, 1978-79, and 1981-82 heating seasons were particularly harsh in Iowa. The 1976-77 heating season is of interest because the September to May HDD total of 6845 is not much different from the normal of 6837, but the winter season total of 4332 (December, January, and February in Table 2) was well above the normal of 3912. In fact, January of 1977 had the highest monthly total over this 12-year period. The peak HDD of the 1976-77 heating season and its effect in terms of natural gas usage and cost can be seen in the time trends in Figure 1. Table 2 and Figure 1 indicate the winter of 1982-83 was welcomed by customers in this area for its below normal HDD totals, especially during December, January, and February (3366, Table 2).

The time trend for dollar cost of natural gas in Figure 1 is noteworthy. Even with the warm weather of 1982-83, expenses were high. Note that the consumer price index was 125.3 in 1972 and 272.4 in 1981. If this general inflation is removed, the price increase does not look so dramatic. Examination of natural gas peak consumption trends in Figure 1 shows a general decrease from 1971 to 1983. This decrease is believed to be caused by conservation efforts; however, the influence of winter severity differences over the time period is a complicating factor. To account for this year-to-year variability, we ran simple linear regressions for each heating season and for each individual household. These results were encouraging as only 1 out of 35 data sets revealed correlations less than $r^2 = .91$, with most greater than $r^2 = .96$. The one data set was associated with one unusual monthly consumption. Examples can be seen in Figures 2, 3, and 4. We acknowledge that some smoothing occurs when using monthly accumulations. Certainly on a day-to-day basis, other meteorological factors would significantly affect daily usage patterns and tend to reduce the correlations.

All three households were different in many ways. For example, family size, age of children, size of house and the number of natural

Table 1. Heating degree day normals for Ames, IA (1951-80).

July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Ann
7	6	99	390	840	1262	1485	1165	961	465	170	24	6874

Table 2. Seasonal heating degree days for Household # 1.

Heating Season	71-72	72-73	73-74	74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83
Sept-May	6832	6878	6588	7093	6093	6845	7557	7918	6655	6044	7287	6583
Dec-Feb	4152	3963	3996	4002	3567	4332	4740	4935	3927	3585	4536	3366

Table 3. Simple and polynomial regression for billing period natural gas consumption and heating degree days for the 3 households during two time periods.

Household	Year	Model[a]	n	Regression Parameters			
				b_0	b_1	b_2[b]	R^2
1	71-73	I	17	68.50	0.16**	0.58^{NS}	.99
		II	17	65.85	0.16**		.99
	81-83	I	18	40.28	0.06**	3.87**	.98
		II	18	23.21	0.12**		.97
2	71-73	I	18	13.77	0.20**	-0.49^{NS}	.99
		II	18	15.76	0.20**		.98
	81-83	I	17	12.12	0.12**	2.86$^{12\%}$	.97
		II	17	-1.56	0.17**		.96
3	71-73	I	15	12.00	0.20**	-1.69^{NS}	.99
		II	15	19.29	0.18**		.98
	81-83	I	18	4.86	0.09**	-0.65^{NS}	.94
		II	18	7.79	0.08**		.93

[a]Model II is the linear model given by $y = b_0 + b_1x$, where x and y are, respectively, billing period heating degree days and natural gas consumption. Model I includes the quadratic term. R^2, b_0, b_1, and b_2 are the coefficient of determination, the intercept, and the slope terms, respectively. The number of billing periods used for each winter season period is given by n.

[b]b_2 must be multiplied by 10^{-5}.

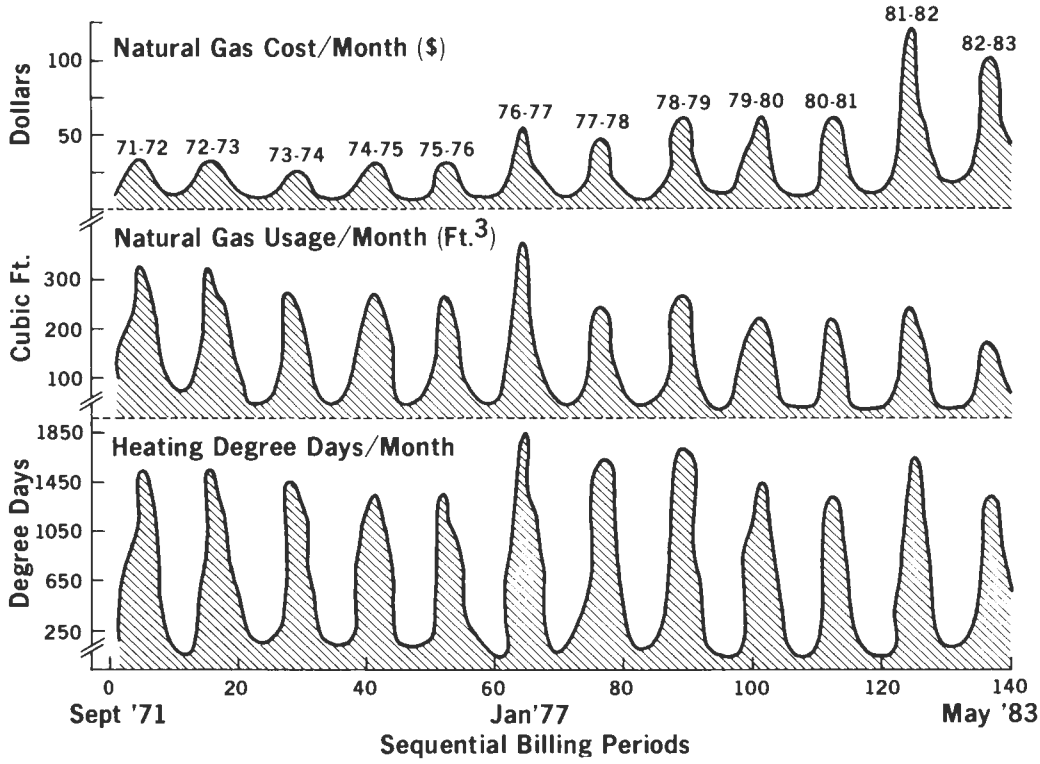

Figure 1. The time trend of natural gas costs, natural gas usage, and heating degree days using a 65° F base temperature for Household #1 for the period beginning September 1971 and ending May 1983. The dollar costs indicated are not adjusted for inflation.

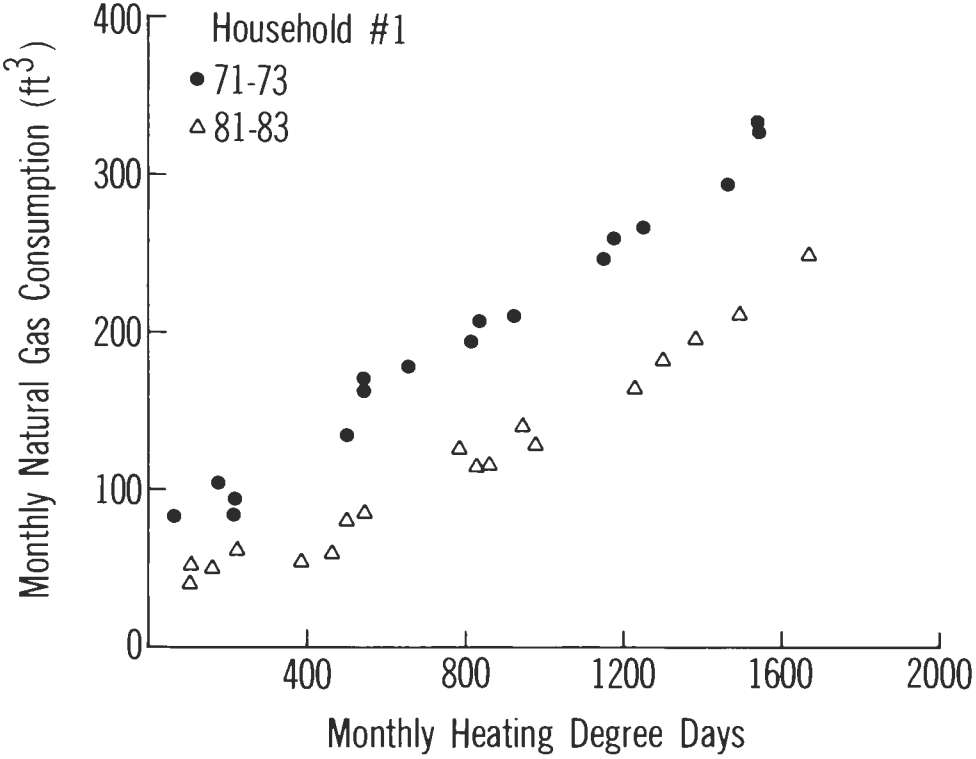

Figure 2. Billing period natural gas consumption and heating degree day relationships for the two time periods, 1971-1973 and 1981-1983 for Household #1.

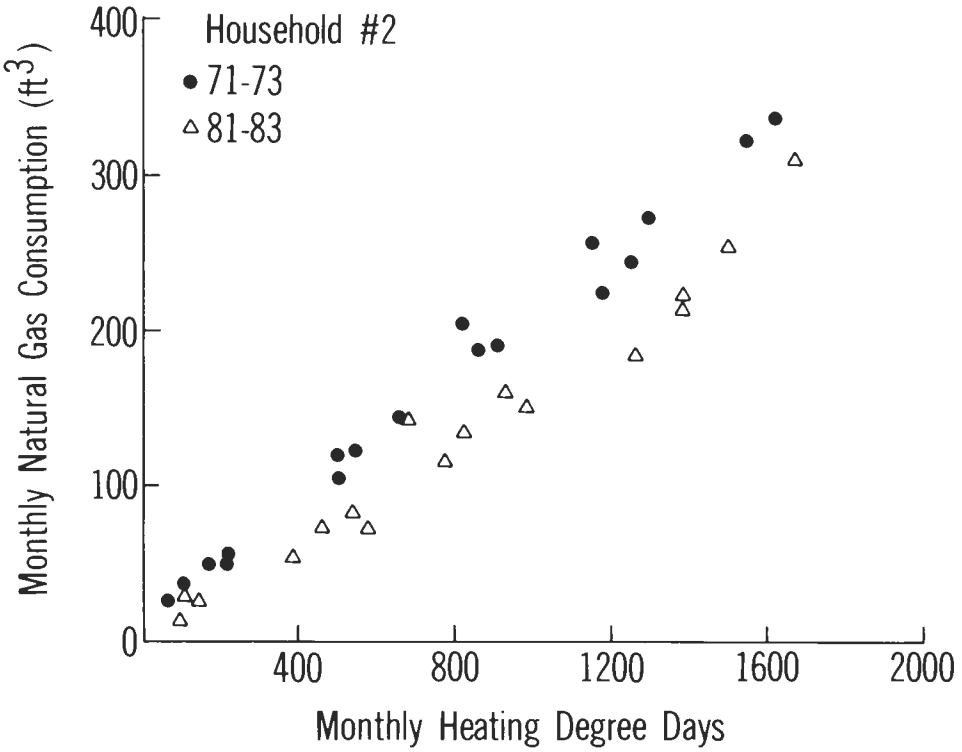

Figure 3. Billing period natural gas consumption and heating degree day relationships for the two time periods, 1971-1973 and 1981-1983 for Household #2.

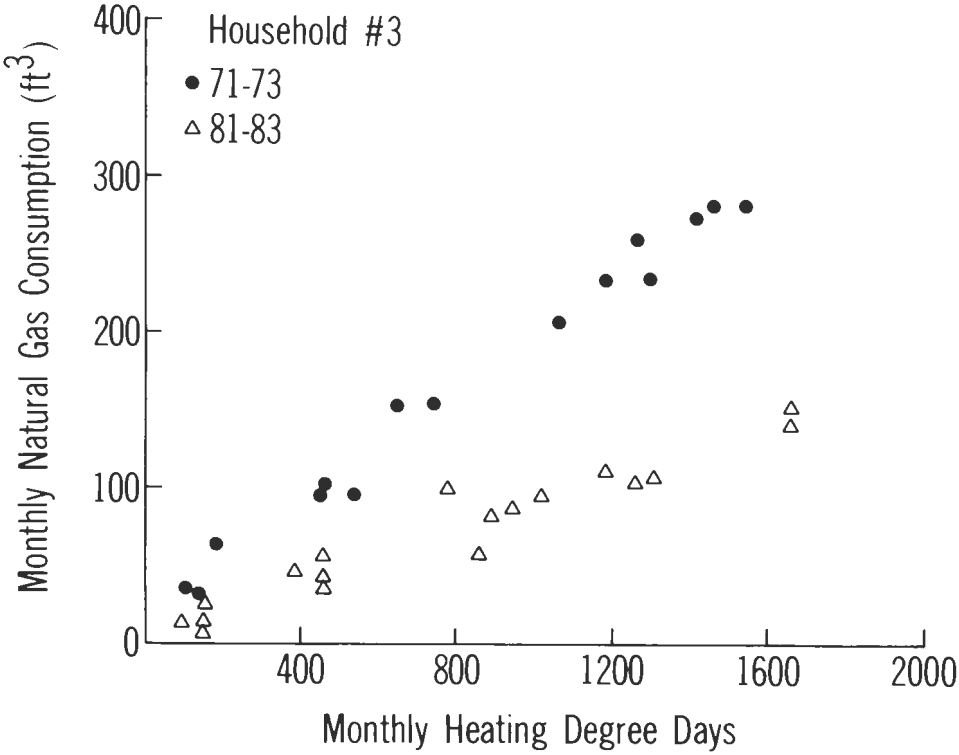

Figure 4. Billing period natural gas consumption and heating degree day relationships for the two time periods, 1971-1973 and 1981-1983 for Household #3.

gas appliances, household environmental aspects, and lifestyles were all different. Each of these factors can influence natural gas consumption. Also, in this study we were unable to separate the amount of natural gas consumed in space heating from other uses, i.e., water heating or outside lighting fixtures. During the winter heating season, space heating was the major use of natural gas in these households. The point we wish to make is that within a given household, an energy-usage pattern existed before the price increases spurred conservation concerns. By using those early years as a base, the regression coefficients then can be examined to note changes over the years. This is similar to the procedure and performance index described by Socolow (1977), except that Socolow used 62°F as the base temperature for HDD calculations instead of the standard 65°F. The base temperature is the average outside temperature at which internally generated heat plus solar gains is presumed to just balance the heat losses.

To achieve conservation in this regard, the general relationship between natural gas consumption and HDD can be altered in three ways. First, the line can be tilted downward indicating that the slope has been decreased. Secondly, the entire line can be lowered or shifted when the intercept term is reduced, but the slope remains constant. Finally, reducing both terms, intercept and slope, drops and tilts the line downward. Each conservation effort can influence either the slope or the intercept individually or affect both in a complex manner. In strict formulation, the intercept is the weather-independent usage. Some that would probably affect the linear dependence of natural gas consumption on HDD include caulking, adding storm windows or insulating curtains, and using a wood burning stove. Conservation efforts which would affect the intercept include a reduction in the use of domestic hot water, elimination of decorative gas lighting, reduced use of gas in cooking, carpeting basement floor or insulating basement walls, etc. Set back thermostats would change the slope and also the intercept at a base of 65°F. Of course, a combination of conservation efforts could change both the intercept and slope. If the size of the change caused by these individual actions were known, the relative advantage of spending $600, say, for storm windows versus basement carpeting could be assessed. As is shown in Figures 2, 3, and 4, each of these households changed their energy consumption pattern over this time period.

Data from Table 3 and Figures 2, 3, and 4 show that all three households reduced the b_1 coefficient over this time period indicating less natural gas consumption per unit HDD accumulation. This effect

was most marked for Household #3 because of the addition of a wood burning system. Examination of the b_0 coefficient in Table 3 and Figures 2, 3, and 4 for these homes also reveals a reduction over time. For all households the b_0 coefficients for both time periods are close to summertime usage. The negative or reduced b_0 coefficient for Households #1 and #2 reveals lack of fit by the linear model and the quadratic model is appropriate. As stated before, we were not able to partition the natural gas usage into space heating, water heating, etc. The point is that if we had been able to do this and then subtracted off that energy used for purposes other than space heating, the intercept should be zero.

Household #1 exhibits a larger b_0 coefficient because it contains more natural gas appliances than the other households. An interesting pattern is evident in Figure 2 for Household #1. In the early time period (71-73), the base temperature of 65°F was probably adequate because the b_0 coefficient was similar to summertime usage. However, in the later period (81-83) interpretation is more complex. The quadratic model fit more realistically than the linear model (see Table 3). Natural gas consumption above base usage was not evident until approximately 350-400 HDD accumulated. Apparently, a much lower base temperature other than 65°F is needed for this household in the later time period. The author has personally noted that in recent years, the furnace does not turn on as quickly. The reasons for this are difficult to pinpoint, but during that time period three items occurred that alter the usage pattern. First, this coincided with the spouse of this household assuming a full-time job. Thus, the thermostat was lowered during the daytime hours of the work week. Secondly, additional ceiling insulation was added, and lastly, a wood burning system was added. It has not, however, been consistently used as was the case for Household #3. All three factors probably affected both regression coefficients, but main effects cannot be identified.

Additionally, close examination of the correlations for each household over time showed that there is a tendency for these values to decrease over time, especially in Household #3. We believe this relates to the manner in which conservation practices are employed. The system (house) is not really steady state as we tamper with it to achieve lower consumption when compared with the preconservation times when we merely set the thermostat to maintain a uniform degree of comfort throughout a heating season.

In summary, assuming a 1200 HDD month, Households #1, 2, and 3 reduced consumption 35%, 21%, and 56%, respectively, comparing

1971-73 and 1981-83 heating seasons. This represents 1982-83 dollar savings of $54, $32, and $79, respectively, for Households #1, 2, and 3 during the 1200 HDD month.

To conclude, these analyses have served to illustrate the natural gas consumption patterns of each household, how they relate to HDD, and how these relationships have changed over time. Tentative identification is made of the effect on the regression relation that would be expected for various conservation practices. Verification of these relaitionships can only be done in a more strictly controlled system (house) than those reported herein. There are many applications of these principles, and they are becoming more important as energy prices rise. The following is a potential list of possible uses for this procedure: 1) in science course projects illustrating computer usage and energy conservation awareness; 2) in housing design problems; 3) in real estate promotional packages for home sales; 4) as a method to assess the effectiveness of conservation efforts, i.e., insulating, wood burning systems, caulking, solar panel addition, etc., and 5) as a method to increase public awareness of energy usage.

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MEMBERS OF CONSERVATION-RELATED ORGANIZATIONS: THEIR CHARACTERISTICS, READERSHIP, AND ACTIVISM RELATIVE TO SPORT HUNTING[1]

Robert B. Dahlgren and Thomas A. Bubolz[2]

ABSTRACT. Adult Iowans who were members of national conservation-oriented organizations were far more politically active on hunting issues than were nonmembers. Further, only those members who read these organization's publications were politically active. Among background variables, education and income were not associated with political activity, but males were more active than females; persons raised in small- and medium-sized towns were more active than those raised on a farm or in a city; persons under 30 were the most active organization members; and persons who currently hunt were most politically active with hunting issues. Members of antihunting organizations were nearly as active as members of prohunting groups. Publications of national conservation-oriented organizations afford natural resource managers the opportunity to convey information to the group of politically active persons most likely to use such information to the manager's advantage. Finally, professional conservationists interested in promoting prohunting causes should be aware that organization members who are against hunting are as likely to be actively pursuing their beliefs as are their counterparts who are for hunting.

Index Descriptors: conservation, antihunting, prohunting, political activism, readership, wildlife sociodemography.

INTRODUCTION

The 1960s were a time of awareness of the value of sociodemographic research to wildlife managers. Much of the early work continued into the 1970s and was concentrated on the characteristics and attitudes of hunters, and on what constituted hunter satisfaction (Peterle, 1961, 1967, 1977a; Bevins et al., 1968; Garrett, 1970; Blummer, 1971; Klessig and Hale, 1972; More, 1973; Potter et al., 1973, bibliography; Schole et al., 1973, a good review; Stankey et al., 1973; Brown et al., 1977; Miller et al., 1977, Wright et al., 1977).

Chiefly in the 1970's, an awareness of the importance of antihunting sentiments to wildlife managers resulted in research on

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attitudes toward hunting and its ethics (Hendee, 1969; Klein, 1973; Brown, 1974; Brown et al., 1978; Brown and Decker, 1979; Kitts and Low, 1974; Linder et al., 1974; Shaw, 1974, 1977; Shaw and Gilbert, 1974; Tocher and Milne, 1974; Kellert, 1976, 1978; Fazio and Belli, 1977; Gilbert, 1977; Peterle, 1977b).

Also in the 1970s, many began to recognize the necessity to examine linkages between behavior and wildlife management (Hendee and Potter, 1971; Applegate, 1973; Hendee, 1974; Kennedy, 1974; Dahlgren et al., 1977; Gilbert, 1977; Kellert, 1977, 1979). Wildlife managers cannot afford to overlook the behavioral aspects of this accumulated research because of the political activity involved. Conservation has become more visibly politicized owing to the greater demands being placed on static or dwindling resources. Increasingly, many conservation-related issues are raised and decided upon in spite of or against the better judgment of professional conservation agencies. These issues frequently deny an appeal to factual evidence; an important decision often is dependent on the amount of perceived political power held by opposing factions. An action taken by a conservation agency may be upset by individuals living in many parts of the nation who are a part of special-interest groups (Shay, 1977), many of whom are conservation-oriented organizations.

Successful professionals in the future may be those who can achieve their objectives by working with and through private conservation groups rather than in spite of them. Such groups are most effective when their positions complement and reinforce those of the professional wildlife manager and are presented to a legislator or member of a conservation commission. To effectively mobilize groups supportive of currently accepted principles of resource management, professional conservationists must establish and maintain channels of communication with their audiences. Many of these audiences are served by more than one "house" publication of a national conservation-oriented organization.

Our main objective in this paper is to illustrate some of the relationships between membership in private conservation organizations, readership of these group's publications, and the members' propensity to engage in politically oriented activities on behalf of the issues supported by these organizations. Additional insight will be gained by examining key sociodemographic characteristics of those who are politically active. Data are presented to illustrate the interdependencies among members of different conservation organizations and the extent of their political involvment. To make this effort manageable, we will focus on issues pertaining to sport hunting.

These issues attract a large following and have a great impact on state and federal conservation programs.

METHODS

This study is based on a random sample, taken in 1976, of 1,500 Iowa residents 18 years of age or older. A mailed 14-page questionnaire was used, with a single followup three weeks after the initial mailing. A total of 1,060 returns was obtained. Sampling methodology was designed and carried out by the Survey Sampling Section of the Statistical Laboratory at Iowa State University. Returns were mailed to the Agriculture and Home Economics Experiment Station to overcome a bias against returns to a hunting-related agency. The sampling frame devised by combining listings in telephone directories and prequestionnaire telephone interviews, assured that the sample was representative of the adult population in Iowa. Study methods were previously described by Dahlgren et al. (1977).

Index values for political activity and organization membership were derived by classifying the 1,060 respondents as to whether they were politically active, read publications, and were members of national conservation-related organizations. Readership is defined as those persons who read at least one of the organization's publications.

Based on our perceptions, organizations were subjectively classified as either pro- or anti-hunting. The prohunting organizations were the National Rifle Association, Izaak Walton League, Ducks Unlimited, National Wildlife Federation, and the Audubon Society. The anti-hunting organizations were the Sierra Club, Wilderness Society, Friends of Animals, American Humane Association, Defenders of Wildlife, and Humane Society of United States.

Two indicators of statistical association are referred to throughout this paper. Kendall's Tau (τ) is a measure of rank order correlation. Tau has a range of $+1$ to -1, indicating, respectively, perfect agreement and perfect disagreement between scores of two variates. A value of zero, or one close to it, indicates that the variates are not related. The odds ratio is another measure of association, the use of which allows a statement such as, "Outcome B is six times more likely to occur when A is present than when A is not," The odds ratio may be calculated from the frequencies in a 2×2 table by dividing the product of the upper left and lower right cells by the product of frequencies in the lower left and upper right cells.

RESULTS AND DISCUSSION

A preliminary examination of the relationships between political action (subsequently called "action," Table 1), organizational membership (Table 2), and readership of organizational publications (Table 3) will be made before proceeding to the investigation of 3-way relationships. This will help determine whether the basic relationships justify further investigation by examing the conditions under which the strength of association may be increased or decreased.

Respondents were asked to indicate if they had taken an active role in controversies about conservation-related issues (Table 1). Eighty-four persons indicated they had taken part in at least one activity. The activities have been listed in an order that roughly indicates an increasing degree of involvement; e.g., the act of contributing to a fund implies less commitment than carrying a petition.

In the sample of 1,060 adult Iowans, 172 memberships were held in conservation-related organizations. Of the 1,060 persons, 582 read conservation-related publication 1,225 times (Table 2).

Respondents were identified as having none (NM) or at least one membership (M) and as having never been active on sport hunting issues (NA) or active at least once (A) (Table 3). Of the 1,060 adults, 146 (14%) were members of one or more conservation organizations. Twenty-six percent of the organization members were classified as politically active, compared with 5% of the nonmembers who were active. For the sample as a whole, members of conservation-oriented organizations were more than six times as likely to be actively involved with issues related to hunting as were their nonmember counterparts. It also is possible to infer that persons with an activist orientation may be attracted to these organizations for the information and support that they provide. Successful initial political involvements by nonactivists could provide a stimulus for their further involvement.

Organization membership, per se, could be a stimulus to political involvement, and it can provide an environment in which support and direction for such efforts may be obtained. An important link between the propensity to act and actual involvement is information that enhances awareness of the existence of problems and perhaps methods for their resolution.

On issues related to sport hunting, many of these stimuli can come through organizations whose major interests involve the growth and encouragement of sport hunting or its elimination. Communications are channeled through organization publications, periodicals,

Table 1. Types of political involvement by 84 Iowans 18 and over related to sport hunting.

Respondents' involvement	N[a]
Contributed to a fund	39
Signed a petition	30
Contacted a government agency	23
Joined a conservation-related organization	16
Contacted a state legislator	14
Contacted a federal legislator	10
Contacted a newspaper	10
Carried a petition	2

[a]Total sample was 1,060.

Table 2. National conservation-related organization membership and readership of their publications among 1,060 Iowans.

Organization	Total number of memberships[a]	Total times publications read[b]
National Rifle Association	30	209
Izaak Walton League	29	256
National Wildlife Federation	26	116
Wilderness Society	26	47
Humane Society of U.S.	23	59
Sierra Club	12	113
Ducks Unlimited	8	116
Audubon Society	7	196
Friends of Animals	7	32
Defenders of Wildlife	3	25
American Humane Association	1	56
	172	1,225

[a]146 of 1,060 persons held a total of 172 memberships in the organizations above. Some persons held multiple memberships.

[b]582 of 1,060 persons read publications a total of 1,225 times. Many persons read several publications.

Table 3. Organization membership (M) and readership (R), each in relationship to political activity (percentage) of adult Iowans. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; R = reader; NR = nonreader; N = number; τ = Tau; P = probability; ω = odds ratio.

	Activism and Membership		Activism and Readership	
	%M	%NM	%R	%NR
A	26	5	12	3
NA	74	95	88	97
N	(146)	(914)	(582)	(478)
	$\tau = 0.27$; $P < 0.001$		$\tau = 0.16$; $P < 0.001$	
	$\omega = 6.68$		$\omega = 4.41$	

newsletters, and "action alerts." Many of these publications have sections devoted to clarification of the organization's position on general and specific issues, on pending legislation that will affect such issues, perhaps including names and addresses of legislators, officials, or commissions sympathetic to specific issues, and provide prescriptive advice about things the reader can do to determine a desirable course of events.

A majority, 582 (55%), of the persons in our sample read at least one publication (Table 3). Of these 582 readers, 69 (12%) had engaged in at least one activity on behalf of issues related to sport hunting. Among the 478 nonreaders, 15 (3%) engaged in at least one activity each. Persons who read organization literature were more than four times as likely as nonreaders to take political action. Like the relationship between membership and activity discussed previously, readership can be both a cause and a consequence of political action. Readership can be a catalyst and stimulus as well as providing resources for sustained involvement. The correlation indicating this symmetric relationship ($\tau = 0.16$, $P < 0.001$) is consistent with this interpretation, although not of the magnitude that we might expect.

To elaborate upon the relationship among indicators of political activity, organization membership, and publication readership, we can introduce individuals' positions on the issues and their experiences as hunters. This means that, although we have demonstrated that there is a moderately strong ($\tau = 0.27$) relationship between organization membership and political action, we expect that, by introducing a third variable, we may be able to specify conditions under which the relationship will be stronger or weaker than the original one.

The primary reason for looking at three-way relationships is to ascertain if aspects of person' backgrounds have any effect on the relationship between political involvement and membership in conservation-oriented organizations. It may be that some subgroups (e.g., persons under 31 years of age) are more inclined to be active organization members than persons who are more than 65 years old. Knowledge of the effects of background variables enables wildlife managers to develop more efficient and effective communication channels because the target population can be more precisely identified. Efficiency is enhanced because information can be directed primarily to groups of individuals who will make good use of it. Effectiveness of communication is improved because a larger proportion of the target audience will take action.

Age

The age of an organization member has an effect on the likelihood of their being politically active on sport-hunting issues (Table 4). For persons 30 years old and under, the odds of a member being active were ten times greater than for nonmembers. In age groups 31-45 and 46-64, the likelihood of a member being active was eight times that for nonmembers, while in the 65-and-older group, the ratio declined to 4.5:1. Odds ratios do not provide a complete picture. Although the under-31 age group had the most active members, all age groups except the 65 and older showed highly significant measures of association (τ) with correlations in the first three age groups of 0.32, 0.27, and 0.30, respectively. Only in the last group did the Tau decline to a marked degree (0.18). If managers are faced with the choice of appealing to only a segment of the population, then the under-30 group would have to be their first choice. The least effective use of resources would occur if communication were directed exclusively to persons 65 and older.

Table 4. Age and organizational membership (percentage) related to political activity of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio. Sample size is 1,048.

	< 31		31-45		46-64		65+	
	% M	%NM	% M	% NM	% M	% NM	% M	%NM
A	39	6	29	5	25	4	16	4
NA	61	94	71	95	75	96	84	96
N	(23)	(232)	(31)	(244)	(60)	(244)	(32)	(182)
	τ = 0.32		τ = 0.27		τ = 0.30		τ = 0.18	
	P < 0.0001		P < 0.0001		P < 0.0001		P < 0.02	
	ω = 10.02		ω = 7.76		ω = 8.00		ω = 4.57	

Sex

Of 146 members in conservation-related organizations, 58% were men (Table 5). That is, men are about 1.4 times more likely to join a conservation-related organization than are women. After joining, however, men are more than five times as likely to get actively involved with issues related to hunting. The degree of association between activity and membership is 0.32 for males and 0.13 for females with the latter correlation having only marginal statistical significance ($P < 0.05$).

Education

We had thought that persons having two or more years of college would be more active members of organizations and would be more likely to follow their convictions with action. College environments may be sensitizers in a political sense for many persons, but our expectation is not supported (Table 6). Roughly one out of every four organization members is likely to become politically involved with issues related to hunting regardless of education. Education, then, does not seem to have an effect on an individual's political involvement with issues related to hunting.

Table 5. Sex and organizational membership (percentage) related to political activity of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio. Sample size is 1,047.

	Male		Female	
	%M	%NM	%M	%NM
A	38	8	10	3
NA	62	92	90	97
N	(85)	(434)	(61)	(467)
	τ = 0.32 P < 0.0001 ω = 7.05		τ = 0.13 P < 0.05 ω = 3.59	

Table 6. Education and income related to organizational membership (percentage) and political activity of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio.

	Education				Income			
	≤ Grade 12		2+ Yrs. College		< $ 10,000		> $ 10,000	
	%M	%NM	%M	%NM	%M	%NM	%M	%NM
A	26	6	27	3	29	4	25	5
NA	74	94	73	97	71	96	75	95
N	(103)	(592)	(41)	(273)	(55)	(329)	(87)	(532)
	τ = 0.26 P < 0.0001 ω = 5.50		τ = 0.34 P < 0.0001 ω = 11.96		τ = 0.32 P < 0.0001 ω = 9.80		τ = 0.26 P < 0.0001 ω = 6.33	

Income

Within the under-$10,000 income group, the relationship between membership and activity has a correlation of 0.32 whereas the over-$10,000 income group's correlation is 0.26 (Table 6). Both correlations are statistically significant ($P < 0.001$). The odds ratio between low- and high-income organization members of 1.2 means that persons earning less than $10,000 are slightly more likely to be actively involved with hunting-related issues than are their higher-earning counterparts. It may be that hunting, as well as any activities related to hunting, per se, is a sport that engenders the commitment of all income levels.

Childhood Residence

Our interest here is in ascertaining if persons with different places of residence in childhood also exhibit different relationships between membership and activity (Table 7). Separate categories were used for persons living in rural areas, in towns having fewer than 5,000 residents, in towns with 5- to 50-thousand inhabitants, and in cities with a population greater than 50,000.

Persons raised in a rural or city setting have the same proportions of active organization memberships (0.17). Likewise, the proportion of persons is almost the same for persons raised in small- to medium-sized towns (0.36 vs. 0.39). In all four subgroups, the proportion of active nonmembers is essentially the same. One possible explanation for the similarity is that persons in the rural group view hunting as being so intimately connected with the land that it can remain unaffected by politics, whereas urban-raised persons may have acquired little commitment to the values of hunting. If the average of the active members is taken for the small- and medium-town groups, persons who have grown up in small- and medium-sized towns are twice as likely to be politically active organization members as are their counterparts who grew up in rural areas or cities with populations in excess of 50,000.

Readership of Organization Publications

Thus far, we have discussed factors in person's backgrounds which might have a differential impact on the relationship between membership and activity. Another important factor is whether individuals who have access to information actually act on it. Of the total of 146 members, only two did not read the publications of at least

Table 7. Location of childhood residence and organizational membership (percentage) related to political activity of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio.

	Farm and rural		Town < 5,000		Town 5-50,000		City > 50,000	
	%M	%NM	%M	%NM	%M	%NM	%M	%NM
A	17	5	36	5	39	4	17	4
NA	83	95	64	95	61	96	83	96
N	(64)	(440)	(28)	(176)	(36)	(178)	(18)	(107)
	τ = 0.15 P = 0.001 ω = 3.89		τ = 0.36 P < 0.0001 ω = 10.69		τ = 0.42 P < 0.0001 ω = 15.34		τ = 0.20 P = 0.09 ω = 2.36	

Table 8. Readership of organizational publications and organizational membership (percentage) of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio.

	Don't read		Read	
	%M	%NM	%M	%NM
A	0	3	26	7
NA	100	97	74	93
N	(2)	(476)	(144)	(438)
	τ = 0.01 P = 1.0 ω = 0.0		τ = 0.26 P < 0.0001 ω = 4.67	

one of these organizations (Table 8), and these two were not politically active. Less than half of the nonmembers read any conservation-related publication. Among the persons who read organization publications, the odds of an organization member being active on issues related to hunting is about 4.7 times that for nonmembers.

Hunting Experience

Intuitively, we would expect that persons who have some hunting experience would exhibit a stronger association between membership and activity than persons who have never hunted, considering that the issues in question concern hunting. Likewise, persons who currently hunt should exhibit stronger association than former hunters. Applegate (1977) has described and summarized studies of recruitment and desertion of persons in the sport of hunting. Among persons who have never hunted, members are about as likely to be active on hunting issues as nonmembers (Table 9); furthermore, the proportion of persons in this class who are politically active is small. The relationship between membership and activity is statistically significant for both groups having hunting experience, and the measure of association is slightly stronger for the current hunters ($\tau = 0.36$) than for former hunters ($\tau = 0.29$).

By analyzing relationships within the former- and current-hunter groups, we may determine the differential impact of membership on activity. Organization members who are current hunters are 6.8 times more likely to be politically active than current hunters who are not members. In comparison, organization members who are former hunters are almost 19 times as likely to be actively involved with hunting issues than are former hunters who are not members of an organization. This comparison illustrates the impact of organization membership in the absence of active personal involvement with hunting.

Position on Hunting

This variable describes the respondent's overall view as being either for or against hunting (Table 10). Our hypothesis was that persons actively against hunting are as likely to be members of conservation-related organizations as are persons actively promoting hunting.

Members who are prohunting are almost nine times more likely to be politically involved compared with their nonmember counterparts.

Table 9. Experience with hunting and organizational membership (percentage) of Iowans 18 years and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio.

	Never hunter		Former hunter		Current hunter	
	%M	%NM	%M	%NM	%M	%NM
A	4	3	16	1	48	12
NA	96	97	84	99	52	88
N	(46)	(369)	(37)	(284)	(61)	(234)
	τ = 0.02		τ = 0.29		τ = 0.36	
	P = 0.96		P < 0.0001		P < 0.0001	
	ω = 1.35		ω = 18.86		ω = 6.77	

Table 10. Attitude toward hunting and organizational membership (percentage) of Iowans 18 and over. A = active politically at least once; NA = never active; M = member of at least one organization; NM = nonmember; N = number; τ = Tau; P = probability; ω = odds ratio.

	Prohunting		Antihunting	
	%M	%NM	%M	%NM
A	40	7	27	5
NA	60	93	73	95
N	(81)	(489)	(15)	(83)
	τ = 0.35		τ = 0.29	
	P < 0.0001		P = 0.02	
	ω = 8.86		ω = 7.03	

For the antihunting group, members are seven times more likely to be active against hunting than their nonmember counterparts. When we compare only active members from the pro-and anti-hunting groups, we find that prohunting organization members are eight times as active as the antihunting organization members.

Overlapping Memberships

Now that we have demonstrated the relationship of organization membership with issues related to hunting, we will focus on the interrelatedness of these organizations through overlapping memberships. Such interrelations are of importance to natural resource managers in two ways. First, to the extent that individuals in a population are members of several organizations, the audience for dissemination of factual information through organization publications will be overestimated. As an extreme example, assume that ten organizations had ten members each and that each person was a member of every other organization. The anticipated audience would be 100 persons, but the actual audience consists of only ten. A second factor to be considered is the reinforcement that a message receives if it arrives through two or more authoritative channels. Readers of organization literature are more likely to view issues as genuinely important if two or more organizations take similar positions on the issue or lend their support to the position of a specific government agency or congressional proposal.

Entries in Table 11 show the total number of respondents who indicated that they were members of organizations listed. Entries in parentheses on the main diagonal correspond to the number of persons in the sample who were members of the respective organizations. These entries add up to 172, the total number of memberships held by the 146 persons who were members of one or more organizations (Table 11). Their average membership was 1.2 organizations per person.

When the table is analyzed, one must be cautious about combining row or column entries because memberships will be counted more than once. For example, the rows labeled NRA and IWL show that three and four of the persons in these respective groups were also members of DU. Summing all off-diagonal values in the NRA row gives the number of memberships in other organizations that were held by NRA members, a total of 18 (7 in IWL, 3 in DU, etc.). Persons who were members of the NRA, on the average, belong to 1.6 organizations. Contrast that with DU whose members, on the average, belong to two

Table 11. Overlapping memberships in conservation-related organizations for Iowans 18 and over. Numbers of members in each organization are in parentheses on the diagonal. Numbers of members for each organization in the left column with overlapping memberships in other organizations are shown in each row. For example, the 26 members of NWF held 14 other memberships (1 in NRA, 2 in IWL, etc.). NRA = National Rifle Association; IWL = Izaak Walton League; DU = Ducks Unlimited; NWF = National Wildlife Federation; SC = Sierra Club; AS = Audubon Society; WS = Wilderness Society; FA = Friends of Animals; AHA = American Humane Association; DW = Defenders of Wildlife; HSUS = Humane Society of United States.

	NRA	IWL	DU	NWF	SC	AS	WS	FA	AHA	DW	HSUS
NRA	(30)	7	3	1	2	1	1	1	1	0	1
IWL	7	(29)	4	2	1	3	1	1	1	0	1
DU	3	4	(8)	2	1	2	1	1	1	0	1
NWF	1	2	2	(26)	2	1	1	2	1	1	1
SC	2	1	1	2	(12)	1	1	1	1	0	1
AS	1	3	2	1	1	(7)	1	1	1	0	1
WS	1	1	1	1	1	1	(26)	1	1	0	1
FA	1	1	1	2	1	1	1	(7)	1	1	1
AHA	1	1	1	1	1	1	1	1	(1)	0	1
DW	0	0	0	1	0	0	0	1	0	(3)	0
HSUS	1	1	1	1	1	1	1	1	1	0	(23)

organizations other than DU. Statistics such as these indicate the potential for cross-communication among organizations, exclusive of formal organization channels. Indeed, there is a great deal of interdependence for all organizations listed in the survey.

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THE GROWTH AND ASSIMILATION OF THE WELSH SETTLEMENTS IN IOWA

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ABSTRACT. Beginning in the 1840s some ten thousand Welsh emigrated to Iowa from Wales and the eastern United States. Although some engaged in coal mining in the late nineteenth century, those who established farms, usually in the same neighborhood, and particularly in Howard, Montgomery, Johnson, and Clay Counties, tended to stay in the state. Probably the major contributions of this group was the establishment of over forty churches (many of them with chapels) in which at first almost all services were held in the Welsh language. However, as the older generation died and newer ones came to be monoglot speakers of English, the Welsh-language churches merged into English-speaking ones in Iowa as in other states. Nevertheless a spirit of Welshness still exists in several Iowa towns which still contain churches which are offshoots of those which had been founded by the old Welsh settlers. Most of the material for this article comes from Welsh-language sources.

Index descriptors: Iowa history, Wales, emigration, Welsh religious denominations, Welsh language

In marked contrast to the neighboring states of Minnesota and Wisconsin, where there are both nineteenth-century and modern accounts, the former in both Welsh and English, very little material about the Welsh settlements in Iowa is available.[2] The purpose of this article is to provide an overview of the history of the settlers from Wales who came to Iowa, and who, to some extent, still remain as a viable ethnic group in the state.

Virtually the only sources of information about the Welsh in the early days in Iowa were written in Welsh. Of them, the Rev. R. D. Thomas' *Hanes Cymry America* [*A History of the Welsh in America*], published in Utica, New York, in 1872, is most detailed about the beginnings of the Welsh group and its churches. In some cases Thomas also gives a list of heads of families, where they were born, and when they came to Iowa.[3] William D. Davies' two books contain selections about Iowa which contain a somewhat fuller discussion of the people themselves, their way of life, and, in general, more personal details.[4]

THE WELSH COME TO IOWA

In 1869 and 1870 Thomas, then living at Mahanoy City, Pennsylvania, visited most or all of the places in Iowa where Welsh-speaking emigrants had settled in fairly large numbers. His book contains a chapter of nearly thirty pages which gives a description of the advantage of settling in the state and a detailed account of the settlements—their inhabitants, their churches and their ministers.

He estimated the Welsh populations as follows: Lime Spring[5] 500; Williamsburg 350; Long Creek (Louisa County) 300; Old Man's Creek (near Iowa City) 300; Oskaloosa Junction 215; Flint Creek (Des Moines County) 120; Welsh Prairie (near Williamsburg) 110; Monroe County (Georgetown) 100; Clay County (near Linn Grove) 50; and Red Oak (mostly at Wales) 40. He also discovered a few Welsh in larger cities such as Oskaloosa (30), Burlington (20), Davenport (20), and Dubuque (20). He mentions thirty Welsh at Marengo, but they can best be considered as a part of the Williamsburg-Welsh Prairie settlement; and fifty in the coal town of Given, a group which apparently did not stay for long.

Welsh settlers began to arrive for the first time at Old Man's Creek around the year 1840. Settlements were established at Flint Creek, Long Creek, and Williamsburg later in the same decade. The 1850s saw the start of the groups at Given, Oskaloosa Junction, and Lime Springs. The Welsh Prairie settlement began in 1860, and the Peterson-Linn Grove and Red Oak ones followed shortly thereafter. Welsh continued to arrive until the early twentieth century.

As an examination of Thomas' *Hanes* and his earlier book *Yr Ymfudwr* [*The Emigrant*] (1865) will indicate, it was the lure of free or inexpensive land which caused the Welsh to cross the Atlantic in search of new homes. Good land was scarce in Wales, much of it was owned by English landlords, and those people who were wealthy enough to pay taxes were forced to support the Church of England which few Welsh attended. Although some of these early settlers came from the more eastern states (3 out of 22 at Williamsburg, none out of 58 at Long Creek, and 3 out of 23 at Flint Creek) according to Thomas' head of household lists, the vast majority came directly from Wales—about equally from the north and the south. After the ocean voyage, the two main routes led through the Great Lakes to Chicago or Milwaukee, or down the Ohio river to Cairo.[6] At the time of his visit, Thomas estimated that there were 2,265 speakers of Welsh in Iowa.

THE CHURCHES

The main Welsh religious denominations were the Calvinistic Methodists and the Welsh-speaking Congregationalists, all of whose religious services were held in Welsh until nearly the end of the nineteenth century. Six churches of the former denomination and six of the latter had been established by the time Thomas arrived. In addition there was an interdenominational church at Flint Creek which subsequently affiliated with the Calvinistic Methodists. By 1870 the Congregationalists had built five chapels[7] (one of which was rebuilt at Long Creek); the Calvinistic Methodists had four (one rebuilt at Flint Creek). Three Welsh-speaking Baptist chapels were eventually built: two at Linn Grove and one at Hiteman, a later coal settlement.

Thomas' figures for the churches, having been based on information from the denominations themselves, may be more accurate than his general population estimates. There were 195 full members, 151 members on probation and children, 222 in the Sunday Schools, and a total attendance of 401 in the Calvinistic Methodist churches. The Congregationalists reported 422 full members, 455 on probation and children, and 880 in the Sunday Schools. That his total is only a little over a thousand can be explained by the fact that he gave no total attendance figures for the latter group.

At this time there were no Welsh Baptist churches in the state of Iowa. These Welsh-language churches were central to the ethnic life of the communities, and remained so until the few remaining Welsh-background congregations finally merged with the English-speaking Congregational and/or Presbyterian groups in the early 1920s.

Although a certain amount of guesswork is involved because of discrepancies in the records, it would appear that the Welsh Congregationalists established some twenty-one churches in the period from 1846 to 1901. Some of them were very short-lived and never were housed in their own chapel. On the other hand, members of this denomination did build some fourteen chapels in eight districts: Long Creek, Old Man's Creek, Oskaloosa Junction, Georgetown, Wales (Red Oak), Williamsburg, Linn Grove, and Hiteman. Of these, one chapel still remains and a church continues to be active at Old Man's Creek. Two others (at Hiteman and at Linn Grove) were still active in the 1930s.

Figures are similar for the Calvinistic Methodists. They established seventeen churches between 1859 and 1907 in eighteen places built some fifteen chapels in thirteen districts: Long Creek (two—which merged into a third), Flint Creek, Welsh Prairie, Williamsburg,

Figure 1. The Old Man's Creek Congregational Church. Built in 1871—the oldest remaining Welsh chapel in the state. Reproduced by permission of the Iowa State Historical Department [State Historical Society].

Linn Grove (two), Wales, Lime Springs, Excelsior, and Bristol Grove, Minnesota (just above the Iowa state line and essentially a part of the Lime Springs-Foreston settlement). Five of them—Lime Springs, Linn Grove, Williamsburg, Salem at Long Creek, and Cotter Presbyterian Church) still exist as Presbyterian churches. In all of these as well as in the Congregational churches with Welsh backgrounds, the descendants of the Welsh are at times in a minority, but a yearly Gymanfa Ganu (hymn singing meeting) has been held at Old Man's Creek on a yearly basis for some time, and Cotter recently celebrated its hundredth anniversary with a heavily Welsh-oriented religious service.

COAL MINING

Unlike Wisconsin and Minnesota, where most of the Welsh settled on farms, there were some Welsh coal miners in Iowa, mostly in Marion, Mahaska, Keokuk, Lucas, Monroe and Wapello Counties, when Thomas visited the state. As a result, two of the later settlements he provides details about (Oskaloosa Junction and Given) were non-agricultural. On the other hand, the census figures for 1900 which are cited below indicate the relative strength of the Welsh in them within a fairly short period of time.

Two decades later, William D. Davies, the traveling representative of *Y Drych* [*The Mirror*,] the largest of the Welsh-American newspapers of the time, visited Iowa. The accounts he wrote as a result of his extensive travels to Welsh settlements throughout the country were published in the newspapaer and later collected into two volumes. In Iowa he found a large number of the coal mining villages with small Welsh populations. These included Angus, Carbonado, Cedar Mines, Cleveland, Lucas, Evans, Foster, Keb, Kirkville, Muchachinock, Mystic, What Cheer, and Willard. Some of them no longer exist, and in some cases it is impossible to know with certainty where they were. Most of these seem to have lasted for only a short time, and, with the exception of Lucas and Hiteman, were never very large.

Like Thomas before him, Davies found a few Welsh scattered in Council Bluffs and Des Moines. The main thing to remember, however, is that the coal miners did not stay in any area for very long, although chapels seem to have been established at Oskaloosa Junction (also known as Beacon), Excelsior, Hiteman (Congregational and Baptist), and Muchachinock.

DAVIES' VISIT

In contrast to the impersonality of Thomas, Davies often refers to specific people and events. Among these are a description of a literary competition at Foreston, a temperance meeting at Williamsburg, a meeting in which people were being taught to use the sol-fa music singing method at the same place, and finally the Christmas Eisteddfod (musical and literary competition) in Oskaloosa.

But beside only one example of growing ethnic consciousness among the Welsh—the possible establishment of a St. David's Society in Des Moines—there were signs that the use of the Welsh language was already declining. Davies heard English sermons at both Old Man's Creek and Wales. At the coal mining area of Beacon he found the people "quickly inclining to use English, and the Welsh church has joined with the English (speaking) one." Still others continued Welsh as he points out:

> On the other hand, the language was strong at Long Creek. The children of the district are nearly without exception reading and understanding Welsh well. Although this is the oldest Welsh district to the west of the Mississippi, I sold my book very well.[8]

The reason for the difference is not hard to discover. In rural Long Creek, the spread out farmers could continue for some time as a Welsh speaking enclave, speaking Welsh on Sunday and in the homes while using English in their business dealings with the Americans. In the coal mines there would doubtlessly have been much more contact with English speakers and thus bilingualism would have developed rather quickly.

Davies also provides some population figures. At Kirkville he found some three hundred Welsh

> all working in, or in connection with the coal mines, except for D. D. Davies who keeps a store there. A Welshman by the name of Richard Rosser is the overseer of the coal works. There is one union church of the Welsh in the place, and I believe that they are cooperating peacefully and successfully.[9]

He also discovered sixty Welsh families in the Wales-Red Oak area.

According to Davies, many of the Welsh in Iowa seem to have originally lived in Pennsylvania (Davies' own home), although,

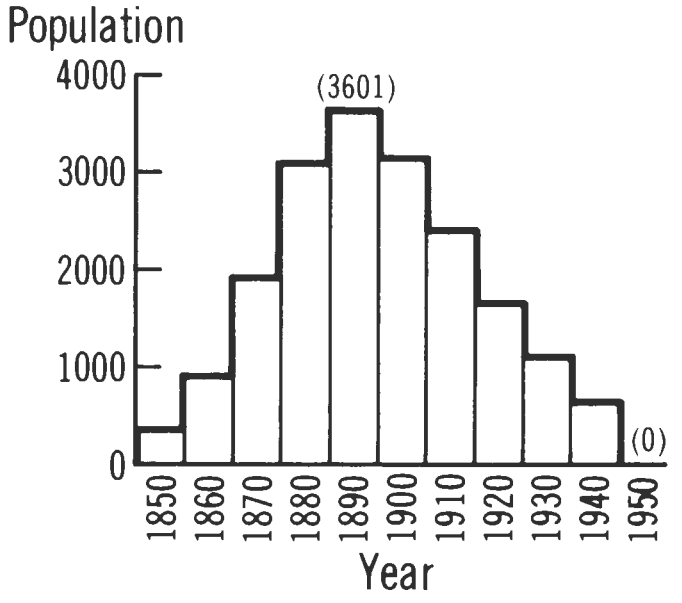

Table 1. The Number of Welsh-Born People in Iowa. Federal census figures tabulated by Leland L. Sage in his *A History of Iowa* (Iowa State University Press, 1974), p. 93.

besides some miners from Missouri, the states of Ohio and Wisconsin are referred to fairly frequently as the previous homes of the Iowans.

THE WELSH POPULATION IN IOWA

It is not easy to determine how many Welsh resided in this state at any given time, but the following figures suggest a total, at its height, of about ten thousand. The 1900 federal census lists 3,091 Welsh immigrants and 6, 419 of their American-born children in the state. This constitutes quite a growth from Thomas' estimate of only a little over two thousand speakers of Welsh and the 1870 census figure of 1,967 people born in Wales living in Iowa. Table 1 gives the number of Welsh-born in Iowa according to census figures. Table 2 shows the major counties where the Welsh lived and their numbers.

Table 2. 1900 Census Figures. Welsh Population in Iowa Counties. A total of 3,091 Welsh born in Wales in Iowa.

Major Settlement(s)	County	Born in Wales	Children Born in America[b]	Total
Beacon	Mahaska[a]	377	842	1,219
Hiteman	Monroe[a]	303	677	980
Des Moines	Polk	188	420	608
Lime Springs	Howard	149	335	484
Kirkville	Wapello[a]	146	328	474
Lucas	Lucas[a]	135	303	438
Wales, Red Oak	Montgomery	124	279	403
Long Creek	Louisa	120	270	390
Colfax	Jasper[a]	100	225	325
Old Man's Creek	Johnson	90	202	292
Linn Grove	Clay	89	200	289
Mystic	Appanoose[a]	78	175	253
Angus	Boone[a]	53	119	172
What Cheer	Keokuk[a]	46	103	149
Marion	Mahaska[a]	31	68	99
		2,029	4,546	6,575

[a]Indicates the coal mining areas.

[b]Approximate numbers.

EVERYDAY LIFE

Unfortunately, except for that provided by Davies, material is rather scarce on the subject of the Iowa Welsh's secular way of life in the early days when about half were engaged in farming and half in coal mining. In addition both Thomas and Davies refer to a few Welsh businessmen in various cities and villages.

Although the sources may contain religious bias, most of the Welsh seem to have been extremely church oriented.[10] There were three services on Sunday, with Sunday School classes for all in addition to prayer meetings, usually once a week. Church members were not allowed to drink, smoking was strongly discouraged, and cooking on the Sabbath was frowned upon.

Two letters from immigrants published fairly recently, however, do give some details about frontier life.[11] In the first, by Joshua Jones of Flint Creek, which was published in a magazine in Wales in 1852, Flint Creek is erroneously called the earliest of the Welsh settlements in Iowa. Jones refers to a temperance meeting, tells of the easy availability of forty acres of land at $1.25 an acre, speaks of a report that there are twenty thousand square miles of land at $1.25 an acre, speaks of a report that there are twenty thousand square miles of coal under the Iowa soil, and ends with a strong suggestion that his correspondent and other Welsh come to Iowa: "Oh! unhappy Welshmen, why do you not emigrate to the New Purchase in Iowa instead of quarreling over the lack of land and poverty in the mountains of Wales?"

In the second, written from the now ghost town of Llewellyn,[12] Iowa, in 1856, the unnamed writer claims to be the owner of 320 acres of land, 240 acres of which he had paid for. He almost laughingly rejects the suggestion of his correspondent that he return to Wales, saying that "my adopted country is better than the land of my birth." A farm of 320 acres in Wales, of course, would have been very unusual indeed.

For the time period after Davies' visits, apart from material scatttered in county histories and newspapers, and material from Welsh church anniversary pamphlets, there is some scarcity of information about the settlements in the later period. There are, however, many articles about Iowa in *Y Drych* (published in Utica, N.Y.)—all written in Welsh until the late 1920s, at which time English came to be used more and more.

One is a series of thirteen articles called "Nodion o Iowa."[13] [Notes from Iowa] by the Rev. Owen Thomas who lived in the towns of Cromwell and Fontanelle during the late 1910s and the 1920s. Apparently Thomas was more or less the official correspondent for general Iowa Welsh news at the time.

Thomas' "Notes" provide something of a picture of the main concerns of the Iowa Welsh during this time period. That they were written in Welsh, in addition, strongly implies that there were still many Welsh-speaking people in Iowa at the time.

Figure 2. The cover page of an Iowa Eisteddfod Program. Reproduced by permission of the Iowa State Historical Department [State Historical Society].

Most important, perhaps, was the Iowa Eisteddfod held at Plymouth Congregational Church in Des Moines. It, acccording to Thomas, and the one in Utica, New York, are the only ones in this country "which are really good." Unfortunately, although he does not say so, an examination of the program shows very little Welshness about it either in the musical and other selections or the contestants. The judges of the competitions, on the other hand, were almost exclusively of Welsh background, and large prizes, $400, for instance, for the best choir, were awarded. But by this time the Iowa Eisteddfod had little Welsh ethnicity to it. Second in importance to a Congregationalist such as Thomas was the church's annual meeting which he reports from Old Man's Creek in 1919 and from Sioux City in 1921.

He also notes that there were still eight Calvinistic Methodist and six Congregational churches in Iowa in 1918. Nothing is said, however, about the use of Cymraeg (the Welsh language) in them, although he does mention that the had been asked to give a sermon in Welsh in Des Moines that same year. He also seconds Davies in referring frequently to Iowa Welsh who had originally lived in Pennsylvania or Ohio.

Thomas was rather indefatigable in his attention to the Iowa Welsh, and it was his and his wife's custom to spend their one month summer vacation traveling around Iowa and the surrounding states to call on old friends from the East (he had originally lived in Ohio), and, in general, any Welsh-Americans he could find. These accounts appeared in nineteen separate articles published in *Y Drych* in 1924, 1925, and 1926. His columns about contemporary events provide some glimpses of the recent past of some of the places he visited, but also, like his earlier dispatches, they give evidence of the continuation of Cymraeg as the language of a fair number of the citizens of Iowa and of other states.

Of considerable interest to him was the use of the Welsh tongue in the churches. For instance he preached at Zion (Long Creek) in 1926 and found Welsh being used in the morning and English in the evening. Although this conflicts with the centennial booklet of the church, I am more inclined to believe a clerical eye-witness than the centennial historian. A year later he visited the same area again but found Welsh apparently discontinued at the church. He rather bitterly remarked that "there was a time when the settlement was certainly one of the most Welsh ones in America, but amazingly, it has turned out to be English," in language, presumably. What apparently happened is that the Welsh-speaking members gravitated to the Salem and Bethel churches, and the non-Welsh speakers stayed at Zion. All

these chapels were about three miles apart.

Thomas provides considerable material about Hiteman, probably once the largest of the Welsh coal mining towns. The town had been established about the year 1889, he said, and he remarked that in the early days the Baptists had held all their services in Welsh but that the Congregationalists used Welsh in the morning and English in the evening. But, he adds, the services in the small Congregational chapel there "for many years...have been completely in English."

The language issue also surfaces in his account of the Eisteddfod held in Albia in 1918. "It was all in English, but nevertheless," Thomas reported, "it was a good Eisteddfod." It is not certain whether this decision was intentional on the part of the Welsh or was caused in part or wholly by a strangely repressive law enacted by the Iowa legislature at the instigation of Governor Harding that no foreign language be spoken in public during the war years.[14] Having himself served the Hiteman church for four years, Thomas revisited the nearby coal areas several times to see their few remaining Welsh citizens. According to him, at its height, Hiteman had contained between two and three thousand people and two Welsh chapels. Although he held out some hope for a revival of the mining business in the area, such was not in fact to happen. He rather tersely summed up the coal mining experience of the Welsh when he wrote, "There is no constancy in the coal works in Iowa. Thousands who have worked here are scattered around the land."

Although he found Welsh in small numbers in many of the towns and cities and villages in the state, he also reports about a more or less unfamiliar area, Dedham, a few miles east of Templeton in Carroll County. He said that nineteen Welsh families settled there "over 50 years ago." Apparently this the same area visited by Davies before the turn of the century and which he called Carroll County. Thomas is a Thomas is a bit unclear about it, but a chapel had been built by the Welsh Congregational church there in 1882 in section 12 of Eden township. In 1913 it was destroyed by a tornado and was not rebuilt. It was at times referred to as "The Little Welsh Church at Templeton."

Finally, Thomas discusses the early history of the churches at Long Creek, Old Man's Creek, and Williamsburg in some detail—material which seems to be generally in agreement with the earlier accounts. He does remind one, also of the important fact that in the early days being a minister to the Welsh churches was a part-time job. Most of the clergy farmed in addition to preaching, and the Rev. David Knowles, the founder of the churches at Long Creek and Old Man's Creek (born in Wales despite his un-Welsh sounding name), found it

impossible to live comfortably on the irregular payment he received. As Thomas puts it, "there was not any particular regular system of paying for the ministry at this time, but now and again there would be contributions to the ministry at some time of the year." Thus the minister was forced "to turn his hand to other activities such as binding books, keeping a school, writing, and so forth." This condition then existed in the Welsh settlements throughout the Middle West.

THE LINN GROVE SETTLEMENT

At about this same time a series of articles about the village of Linn Grove and the Welsh farming settlement to the north of it—a group which had begun in 1864—appeared in *Y Drych*. Between 1917 and 1925, the local representative, Philip Phillips wrote nearly fifty reports in Welsh under the title "Llith of Linn Grove" [Notes from Linn Grove.][15] The area seems to have contained about five hundred Welsh at the time, a majority of whom seem to have come from Wisconsin or other eastern states rather than Wales itself, although Phillips himself had been born overseas.

These accounts describe everyday life in considerable detail. Except for the war, however, his reports center around the religious activities of the two Baptist (his own denomination) and the two Calvinistic Methodist (by this time Presbyterian) chapels in the area. The most interesting material from an ethnic standpoint deals with intermarriage. The Welsh—partly because of their language—tended to intermarry in the early days, and this seems to have also been the case at the start of this settlement. But of the seven marriages Phillips reports on in the 1920s, only one was between two obviously Welsh people (Powell and Evans).

But, as has been mentioned, the church was central. Phillips reports revivals, Sunday School celebrations, singing meetings, the coming and going of ministers (with strange silence about the Lutherans), as well as secular ones such as war and post war gatherings, fourth of July and Memorial Day celebrations, high school graduations (usually addressed by one of the Welsh ministers), and on one occasion a Chautauqua. His obituaries almost invariably include something like "the old settlers are passing away quickly." Some of these notices mention the old Welsh custom of singing hymns at the graveside. Concomitantly, sermons and services in Welsh seem to have come to an end in 1918 or 1919.

In passing, he gives considerable information about the four churches. For one thing, the two groups seem to have cooperated well, co-sponsoring revivals, singing meetings and the like. Phillips was

particularly fond of the Rev. W. C. Rowlands, a Presbyterian minister who had been born in Anglesey, Wales, and who served there for a few years. One reason for Phillips' admiration may very well be that the was probably the last Welsh-speaking minister to live in the town, and that as his old friends died, Phillips, who obviously preferred to write in Welsh, may have enjoyed talking and listening to him in the old tongue. Rowlands moved to an English-language church in Alta, Iowa, in 1918. He was followed by a minister with a Welsh-sounding name who stayed for only one year; subsequently none of the names of the ministers have a Welsh sound to them.

By combining material from a history of Buena Vista county[16] and Phillips, quite a detailed history of the churches can be pieced together. The country Baptist chapel, Moriah, was built in 1867. Phillips reports that it was struck by lightning in 1918 and burned to the ground. After considerable soul-searching, it was decided not to rebuild it, its membership being small and the automobile having become a factor. Thus the members joined the town church which had been established in 1890. This building still exists, being used as a storehouse for cattle feed.

The first Calvinistic Methodist chapel, Seion, was built in 1875 and the second, Peniel, a few years later. They were served by the same minister. In 1921, Phillips reported that the services in them had been discontinued, although a series of articles in the *Spencer Sunday Reporter*[17] suggests that they ended in 1923 or 1924. It is rather probable that both dates are accurate insofar as regular services may have ended in the former year, but that the chapels were used on a few special occasions until the later date.

Most poignant is a report from 1923: "Eli Roberts and his wife have come back from Wales. . . . They did not feel at home in Wales, and it was a pleasure for their friends to greet them on their return." This, like the marriage statistics, seem to show that the Welsh in Linn Grove were quickly becoming Americanized here as elsewhere.

THE CHICAGO EISTEDDFOD

Thus it would appear that the Iowa Welsh attended their churches, mined in decreasing numbers as time passed, farmed, or ran their small businesses in the villages withought bringing a great deal of attention to themselves. The one major exception was documented by Ben Hur Wilson in 1941 in his article, "The Iowa Eisteddfod."[18] To summarize, in 1888 the Welsh miners of Kirkville organized a choir and held a Christmas Eve concert in the local

Congregational church. Religious and classical songs were sung in both Welsh and English, and selections of poetry were declaimed. Apparently, unlike the later meetings, it was not competitive. The event proved so successful that the Iowa Eisteddfod Association was formed the following year, and similar events (now competitive) were later held at Oskaloosa or Albia (at the King Opera House)[19] each year at Christmas, and finally at Thanksgiving time because of Iowa weather conditions, until 1919.

Had this been all that Wilson could report about the matter, his article would have little interest. Such was not the case, however. With primarily Welsh choruses now already present in several towns, it was decided to send an Iowa male chorus to the Chicago World's Fair in 1893 where an international Eisteddfod was to be held in September. Wilson's account of the preparations and the Iowans' competition makes fascinating reading and will be summarized briefly.

For a period of months, groups of local singers practiced separately and did so together in a body every two weeks or so. Money for traveling expenses—one thousand dollars a person—was raised in various ways. The Iowa group competed with six other choruses of between fifty and sixty members all singing "Cambria's Song of Freedom" and "The Pilgrims". Two of them had come from Wales to compete for the first prize of one thousand dollars. Although the Iowans did not receive a prize, Wilson saw it as an important event for the Iowa Welsh:

> Throughout the years, the participation of Welsh singers in the musical festival of the Chicago World's Fair remained a highlight, not only in the lives of the individual members but in the annals of the Iowa eisteddfod as well.

More importantly, perhaps, the trek of the Iowa coalminers to the Windy City to compete with groups from the East and from Wales, itself is the sort of material from which myths are made.

CHARACTERISTIC CHURCHES

Although it would be interesting to describe what is known about all the old Welsh-language churches in Iowa, it will be necessary to limit discussion to those in areas whose histories are well documented and which are characteristic of the others: Long Creek, Old Man's Creek, and Lime Springs.

Based upon the church's centennial progam[20] and Thomas' *Hanes*, the Long Creek Congregational church (originally Zion and eventually the Welsh Congregational Church of Columbus Junction) is the oldest Welsh church in Iowa. The Rev. David Knowles probably preached the first Welsh sermon west of the Mississippi to a small group near there in 1845. The church was organized the next year, and two years after that a private house was purchased for $175 and was remodeled for the group's use. A second chapel (34 by 26 feet) was built in 1846 at a cost of one thousand dollars. The final one was constructed in 1887. It was torn down in 1967 after final services were held.

As a result of doctrinal differences among the Welsh, in 1859 some people departed and eventually, in 1861, affiliated with the Calvinistic Methodist church. This group called itself Salem and built a chapel a few miles away from Zion in 1875. The present chapel, which is still in use, was built in 1909.

Another Calvinistic Methodist church, Bethel, was established and met in the Yankeeton schoolhouse in 1879 until a chapel was built half a mile west of it in 1885. The structure was struck by ligtning in 1906 and burned, and in the following year a new building, costing $5,000, seating 350, and now called Cotter Presbyterian church, was built a mile north. This church, now Cotter United Presbyterian, still exists and celebrated its hundredth anniversary in 1979. It had 115 members at that time and had ministers with Welsh-sounding names from the start until 1914. About 38 of its present membership of 101 have Welsh backgrounds.

Despite the departure of a group from it, the Long Creek church flourished, and by 1884 had a membership of 115. R.D. Thomas reported that it had a congregation of 150 by 1872, but there were only 80 regular members. In 1931 it had 131 members.

As in all churches, the use of Cymraeg had to come to an end. In 1914 the evening sermon was given in English, and in 1923, Welsh was discontinued completely according to the church's history. However, the Rev. Owen Thomas reports that this took place in 1926. Apparently English was first used at Bethel at the chapel dedication in 1907.

At the time of Zion's anniversary, all four members of the centennial committee had Welsh names as did all the church officers. The final services were held in 1963 and the chapel was torn down. A memorial stone is located at the Cambrian cemetery.

The history of the Welsh Congregational Church at Old Man's Creek[21] is not dissimilar. It too was established by the Rev. David Knowles in 1846 and celebrated its centennial in 1946 and the centennial of the

construction of the present chapel in 1970. They worshipped in private homes and a log school house during the early days. And as at Long Creek, a small group left and formed Unity Presbyterian church in 1858 and built a small chapel about five miles north-west of the other. The main reason tor the split seems to have been the use of Cymraeg. The services at Unity were in English from the start. At Old Man's Creek a chapel was built in 1858, and a second one was completed in 1871. It still stands and is used on Sundays, although there were no services from 1954 to 1972. It has been entered on the National Register of Historic Places.

The Welsh language faultered more quickly here. As early as 1871 there was one English sermon a month and English Sunday School classes for those who wished them. Thee final Welsh-language services were held in 1914 during the pastorate of the Rev. J. Meryddon Jones, its last "Welsh" minister.

In R.D. Thomas' time it had 140 members; today it has about 45 active members; something like a fifth of them are descendants of the old settlers.

Of slightly later establishment were the three Calvinistic Methodist churches in the Lime Springs area.[22] A few settlers from Wisconsin arrived in 1867, and a church at Foreston was established in that same year. There were 147 members in 1893 housed in one of the largest rural Welsh chapels in the country.

In 1867, in addition, a church was established at Bristol Grove, just slightly north of the Iowa border and in the state of Minnesota. A chapel was built there in 1874 at a cost of $2,000. In 1893 it had 150 members.

The two churches were successful for some time, but by the turn of the century the country churches weakened as more and more of the farmers retired to Lime Springs. During much of the time the same minister served both country churches, and after the town church came into being, all three of them. Thomas reported 99 members at Foreston in 1872.

The automobile and the church in town, however, spelled the doom of the rural congregations. The chapel in town was built in 1892 but tragically burned to the ground three days before it was to be dedicated. Undaunted, the group of fifty members rebuilt and opened it the same year. The building cost $2,600 and is still the home of an active congregation.

Cymraeg seems to have fared better in the town than in the churches in the country. As late as 1931 there were still two Welsh services a month in the morning, but soon it was determined to

discontinue them. The pastor at the time, the Rev. R. Lewis Jones, born in Wales, in order to placate some of the members, agreed to hold Welsh services two Sunday afternoons a month. But when he left in 1936, the services--almost certainly the last regularly scheduled ones in that language in the state--ended. The church remains active, having celebrated its seventy-fifth anniversary in 1977. Almost all of its present members are descendants of the Welsh settlers.

At Foreston, English started to be used for services one Sunday a month in 1914, and as the Rev. Daniel Williams wrote in *Y Drych*:

> While he [the Rev. David Edwards] was here English came in fairly strongly. The government of Iowa stressed that all the ones from overseas should all turn to English during the war, and there was English on Sunday night for that reason.

It appears, however, as if the morning services were still in Welsh.

Williams also reported the decline at Bristol at the same time. The chapel was only about half full on Sundays, but Williams was still preaching there "when the weather and the roads allow it."[23]

As to Foreston, the chapel was closed and all services were discontinued in 1923, only a few months before the fiftieth anniversary of the building, and the members joined the town church. The building itself was torn down in 1925. The Bristol Grove church continued until 1933, and the chapel was sold to a Baptist group in 1945. It was torn down later, but a wooden sign marks the site.

There is an account in *Y Drych*of a jubilee held at Foreston on August 17, 1924[24]; it probably was written by the same minister. The meetings took place morning, afternoon, and late afternoon. There were sermons, singing, and many of the old settlers told of their experiences at the old chapel. Fifty previous members were there as well as seventy five from Bristol Grove.

THE WELSH IN IOWA TODAY

As to the present profile of the descendants of the Welsh immigrants in Iowa, in addition to the two churches in the Long Creek area and the one at Old Man's Creek, Lime Springs, and at Linn Grove, there are also active Welsh-rooted churches still in existence at Wales and Williamsburg.

The former, now officially known as the Cooperative Parish of Carson-Sharon-Wales United Presbyterian Church, worships in a chapel built in 1900. It has 82 members, three quarters of whom have

Welsh roots. The group published a pamphlet at the time of its anniversary in 1947.[25] As to its past, in May 1874 a group of Calvinistic Methodists established a church, and a chapel was built at a cost of $1,000 two years later. An addition was built in 1880. In 1921, over the strong objection of some members, it affiliated with the Presbyterian church. In 1946 most of the members of the nearby Gomer Welsh Congregational church joined the congregation. The final services in Cymraeg probably were held during the time of its last Welsh-speaking minister, the Rev. E.W. Griffiths (1921-1926).

The First United Presbyterian Church of Williamsburg[26] represents a merger of a Welsh Calvinistic Methodist and both a Welsh and an English-language Congregational church. About one third of its total membership of about three hundred are Welsh-connected. The two Welsh churches joined in 1957 after the Welsh Presbyterian chapel burned. That group then began to worship in the present English Congregational chapel which had been dedicated in 1917. Present at the dedication had been Mrs. Ann Evans, the widow of the first resident minister of the Welsh Congregationalists there.

The Congregational group had been organized in 1856, and a frame chapel was built three years later. It was enlarged in 1871 and a new brick structure was completed in 1890.

The use of Welsh for the services, as at Old Man's Creek, declined comparatively early. In 1897 English began to be used for evening services and for one morning sermon a month. Final services in Cymraeg took place in 1911 although ministers with Welsh names continued to serve the group until 1928. The Calvinistic Methodists had established a church in the town in 1898 and built a chapel shortly thereafter.

In comparison to the neighboring states of Wisconsin and Minnesota with their frequent gymanfas and touring musical groups from Wales, Iowa now has a considerably lower ethnic profile. There seems to be little evidence of Welshness except for the one gymanfa at Iowa City, and, of course, the few remaining chapels originally founded by the Welsh pioneers.

The annual gymanfa at Old Man's Creek had its origin in a picnic, held on the Sunday closest to the fourth of July, which began in 1916. Attendance is usually between eighty and a hundred people. Most recently there has been a church service in the morning, a luncheon in the church basement at noon, and the hymn singing in the afternoon. Welsh descendants, primarily from the eastern part of Iowa, attend it regularly.

The Minnesota-Iowa Gymanfa is annually held in or near Mankato, about a hundred miles north of the Iowa border, but few Iowans attend it. The same is probably true of the National Gymanfa held yearly during the Labor Day weekend. The program for the assembly in Minneapolis in 1978 lists only one Iowan who contributed enough to be listed as a patron in the program. In contrast, three from Minnesota and ten from Wisconsin were commended for their generosity.

Also, unfortunately, of the sites of all the former chapels in the state only two (Bristol Grove and Zion), as far as I know, are marked, and of course, only three chapels of pre-1900 vintage remain (Old Man's Creek, Salem at Long Creek, and Lime Springs). There also has been a comparative lack of printed church histories compared to those in Minnesota and Wisconsin.

Many descendants of the original Welsh settlers still live in this state. According to the 1980 census, 30,677 Iowans claimed to be of Welsh background on one side of their family. Of these, 6,083 said they were Welsh on both sides. But it would appear that consciousness of ethnicity among the Welsh-Americans in Iowa is at a somewhat lower level than it is in such neighboring states as Wisconsin and Minnesota. On the other hand it would be unfair to suggest that it does not exist. It is merely that, except in the Iowa City-Long Creek area, the remnants of the old settlements are widely spread out over the state. Still, the fact that some Iowans attend the St. David's Day Society meeting in Lincoln, Nebraska, the gymanfa in Mankato, Minnesota, and the national meeting suggests that in this day of heightened ethnic awareness, there may be a revival of some sort of state-wide Iowa Welsh gathering in the future.

NOTES

[1] Dr. Davies is Professor of English at Iowa State University. Although he has done conventional literary scholarship, he has recently become interested in Welsh immigration to the Midwest.

[2] Relatively early works in English include Daniel Jenkins Williams' *The Welsh Community of Waukesha County* (Columbus, Ohio, Hann and Adair, 1926), Rev. Howell D. Davies' *Oshkosh, Wisconsin, Welsh Settlement Centennial*, 1847-1947 (translated from Welsh, Amarillo, Texas, Russell Stationary Co., 1947), and *History of the Welsh in Minnesota, Foreston and Lime Springs, Ia.*, edited by Rev. Thos. E. Hughes, et al (Mankato, 1895), part of which is in Welsh. Recent works include a section in *They Chose Minnesota; A Survey of the State's Ethnic Groups*, ed. June Drenning Holmquist (St. Paul, Minnesota Historical Society Press, 1981) and my pamphlet, *The Welsh in Wisconsin* (Madison, The State Historical Society of Wisconsin, 1982).

[3]See my translation (Lanham, Maryland, University Press of America, 1983). Parts of the chapter on Iowa appeared in *The Palimpset* (Vol. 59, No. 1, January/February 1978).

[4]My translation of selections from Davies' *Luybrau Bywyd (The Paths of Life)* (Utica, N.Y. 1889) and *America, a Gweledigaethau Bywyd (America, and the Politics of Life)*(Merthyr Tydfil, Wales, 1897) appeared in *The Annals of Iowa* (46: 4, Spring 1982). The full text of Davies' material about Iowa is available at the State Historical Society's libraries in Des Moines and in Iowa City.

[5]This town was usually referred to as Lime Spring until 1949 when the name of its Post Office was changed to Lime Springs.

[6]My *The Welsh in Wisconsin* gives additional information on conditions in Wales, the trip to America, the farming practices of the Welsh, and the like.

[7]In order to avoid ambiguity, I have used church to refer to a group of like-minded Christians who meet together either inside a building intended to house worship services (a chapel) or in private homes, schoolhouses, etc. For instance, three rural churches had been established near Lime Springs by 1872, but only one of them (Foreston) ever constructed a chapel.

[8]Davies, *America*, p. 230 and p. 135. (My translation).

[9]Davies, *Llwybrau*, p. 262 (My translation).

[10]Thomas lists six Calvinistic Methodist ministers and two preachers, and nine Welsh-Congregational ministers as residing in Iowa.

[11]These letters appear in Alan Conway's *The Welsh in America: Letters from the Immigrants* (University of Minnesota Press, Minneapolis, 1961).

[12]No Llewellyn is listed in any of the various compilations of Iowa's ghost towns and abandoned post offices. It is likely that several Welsh had settled close to each other and called the area Llewellyn, a common Welsh personal name.

[13]I have translated the quotations from both series of despatches from Thomas that follow.

[14]Nancy Derr, "The Babel Proclamation" *The Palimpsest*, (Vol. 60, No. 4, July/August 1979).

[15]I have translated the quotations from Phillips. Copies of *Y Drych* for this period are available at the Center for Research Libraries in Chicago.

[16]C.H. Wegerslev and Thomas Walpole, *Past and Present of Buena Vista County* (Chicago, S.J. CLarke Publishing Co., 1909).

[17]The four articles appeared in November, 1960.

[18]Ben Hur Wilson, "The Iowa Eisteddfod," *The Palimpsest* (Vol. 22, No. 12, December 1941).

[19]The King Opera House in Albia is undergoing restoration and is now known as the Barbary Coast Opera House.

[20]"Centennial Program of the Welsh Congregational Church; Columbus Junction, Iowa, 1846-1946" (1946); "Cotter United Presbyterian Church" (Centennial pamphlet, 1979); and "History of Cotter Church" (Manuscript, no date). Most of

these and other church histories mentioned in later footnotes are available at the Iowa State Historical Department in Des Moines.

[21]"The History of the Welsh Congregational Church known as 'Old Man's Creek', Iowa City, Iowa" by George Reichard (1946); "100th Anniversary of Welsh Congregational Church of Old Man's Creek" (1970).

[22]There is no church history. Material can be found in Hughes (see footnote 2) and W.E. Alexander, *History of Chickasaw and Howard Counties* (Chicago, Western Publishers, 1883).

[23]"Dr. Daniel Williams, "Byr Hanes o'r Capel Foreston" ("A Short History of the Foreston Chapel"), *Y Drych*, May 15, 1924. (My translation).

[24]Dr. Daniel Williams (?), "Jubil at Hen Capel Foreston" ("Jubilee at the Old Chapel at Foreston"), *Y Drych*, August 28, 1924. (My translation).

[25]"100th Anniversary Wales Presbyterian Church (1974).

[26]Anniversary Edition of Church Directory (1982).

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MYTHOS AND *MISE-EN-SCÈNE*: RETHINKING CHAPLIN

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ABSTRACT. "Mythos and *Mise-en-scène*: Rethinking Chaplin" challenges three commonplaces of Chaplin scholarship: 1) that Chaplin's famous "tramp" figure is a social outcast or loner in some clear cut fashion, as if Charlie's exclusion from society were always society's doing; 2) that Chaplin's film style is a minimalist and theatrical (hence uncinematic) reflection of his formative years as a music-hall comic; and 3) that *The Gold Rush* can serve as a typical example of Chaplin's mature filmmaking. In the first instance it can be argued that the tramp character's relation to society is not static but always in question, and that Charlie's typical departure *from* society at film's end is a departure he in some sense *chooses* to make. In the second case, examination of film style in *Behind the Screen* demonstrates even early in Chaplin's career a capacity for stylistic innovation and self-assertiveness rarely attributed to Chaplin's direction. And against the background of these first two assertions *The Gold Rush* can be seen as a remarkably *atypical* Chaplin film, especially in respect of the film's sexual relationships—though exactly therein lies much of the film's considerable value and interest.

Index descriptors: Chaplin, *The Gold Rush*, *Behind the Screen*, film comedy, silent film, silent comedy.

INTRODUCTION

It is one of the major scandals of Anglo-American film criticism that so little of genuine intellectual and interpretive merit has been written about the films of Charlie Chaplin. Film scholars are not altogether at fault here. The heydays of auteurism—when Chaplin should have been investigated with the same measure of rigor and concern devoted to Hawks, Ford, and Hitchcock—coincided with a period when most of Chaplin's feature films were generally unavailable for viewing, or were available (as I remember) only at great cost, as a package deal. Also involved is the long standing opinion that Chaplin, while a great comic, was not a great filmmaker. And then there was (and is) the sheer bulk of Chaplin's output to contend with—even excluding the features, where does one begin? A final issue to reflect upon involves the fact that *The Gold Rush*—which continued to be shown when the other features were withheld from distribution— has long been considered such a perfect embodiment of the Chaplin thematic that it could be allowed to stand for the whole

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canon. Significantly, it is the one Chaplin feature upon which an extended critical tradition has been established.

I do not propose to remedy the situation singlehandedly—nor is that necessary. Gerald Mast (1979), Walter Kerr (1979), Nöel Carroll (1979), Michael Roemer (1974), and Wes Gehring (1983) all have made significant contributions in the last decade or so to our general understanding of Chaplin's career and accomplishments. Yet I believe it demonstrable—even by relatively brief reference to a select few Chaplin films—that much work remains to be done. More specifically, I want to second Wes Gehring's suggestion (1983; pp. 63-72) that the notion of Charlie as "the tramp" needs thorough revision. I also want to reconsider the status of Chaplin's *mise-en-scène*: to what degree is Chaplin's camera merely a recording device? And finally, I want to rethink certain aspects of *The Gold Rush* for the purpose of suggesting that in certain crucial respects it is a remarkably atypical Chaplin film, far more so than the majority of Chaplin critics would have us believe.

THE MYTH OF THE TRAMP

No single image in the history of cinema is better remembered (or misremembered) than that which follows (Fig 1). What is this an image of? Or consider the following passage from De Nitto and Herman's *Film and the Critical Eye* (1975; p. 78).

Figure 1.

> He is the perennial outsider. Even in a crowd, such as in a dance hall in Alaska or at a party of socialites, he is alone. People cannot control him and he sees beneath their hypocrisies and defenses, their superficial values and

> cramped emotions. So they punish him for his freedom, which they secretly envy, and his perceptiveness, which they fear, by either ignoring him or bullying him. The wanderer, Jew or Gentile, is a convenient scapegoat.

What is the object of this description—to whom does "he" refer?

The answer to both questions is the same. Chaplin. The Tramp. The answer comes almost too readily to mind, as if something were being avoided, an issue skirted. As Walter Kerr (1979) among others has pointed out, Chaplin-the-actor very seldom played the "role" of the tramp—even late into his tenure at First National. After making *The Tramp*, for example, "he went right on adopting new disguises, appearing as a paperhanger, a floorwalker, a fireman, a studio property man, a policeman, an escaped convict, a wealthy drunk, even Don Jose in *Carmen*" (p. 81). Indeed, for Kerr, "the secret of Chaplin, as a character, is that he can be anyone" (p. 85). It is a striking insight, to which we will return. But not even Kerr himself can avoid the pressure of the Chaplin-as-tramp archetype (as his subsequent discussion of *A Dog's Life* clearly indicates).

Perhaps it is a pressure that *cannot* be resisted. As André Bazin puts it in *What is Cinema?*, "Charlie is a mythical figure who rises above every adventure in which he becomes involved" (1967, p. 144). Can *we* rise above the figure? Perhaps not. But we can rewrite it.

The reasons for doing so, for rethinking the implications of the Chaplin mythos, are several. Partly it is a matter of desire: only by so doing can a space be cleared for further critical inquiry. But there is also an objective sense in which the archetype ill serves the films. The archetype is almost static—both visually (the still image) and dramatically. Thus in the passage just cited (and this holds true for all of the many like it throughout the literature on Chaplin) Chaplin is defined in fairly clear cut social terms—as the outsider who momentarily found his way in, as the outsider who stands (he always *stands*) and looks, as the outsider who is punished and rejected. "The Outsider." What such a description fails to capture, among other things, is a special kind of force or motion that is seen repeatedly in Chaplin's films, a gesture of choice, of *choosing* to be "the tramp"—and on terms which imply a rejection on Charlie's part of the class system connoted by the inside/outside paradigm implicit in the generally accepted picture of Chaplin's tramp character.

Clearly Chaplin *can* be an outsider in a given film, especially at the beginning. Thus in *The Tramp* we first see Charlie out of doors, walking down the road; *The Vagabond* begins with Charlie coming out

of a saloon, and it continues with his departure/escape from, first, the members of the brass band, and, second, the band of gypsies; *Easy Street* begins with Charlie sleeping outside, by the stairway of the mission; in *The Immigrant* Charlie is first seen on deck, hanging over the ship's railing, with his back to us; *A Dog's Life* opens with Charlie asleep outside, against the fence which surrounds an otherwise vacant lot; *The Pilgrim* begins with a shot of the outside of a prison, and when we first see Charlie he is pacing, in his borrowed parson's regalia, up and down outside a railroad depot.

Correlating with this physical and spatial outsideness is a kind of "outsider" social status: Charlie is either impoverished, on the verge of hunger and skirting the edge of the law (as in *The Tramp*, *The Vagabond*, *Easy Street*, *A Dog's Life*, and *The Pilgrim*—in all of which he resorts, if only momentarily, to theft); or else Charlie is somehow out of sync with the society he inhabits. In *The Tramp*, for instance, Charlie does his best to play the role of the farmhand, but his efforts are either destructive (the pitchfork in the foot, the grain sacks on the head) or ineffectual (irrigating trees with a hand-held watering can).[1] In *Easy Street*, to take a second example, Chaplin also adopts an approved social role, as policeman, but he is clearly unlike every other policeman on the force, in stature, in tactics, in gestures, in values. Perhaps the clearest image one can have of Chaplin's social idiosyncracy is seen in the early moments of *Shoulder Arms* when Charlie does his level but ineffectual best to march in step and keep in formation; it just doesn't seem to work—his feet keep turning *out* rather than *in*.

All of which accords clearly enough with the accepted version of the Chaplin mythos—but as I would rewrite the "tramp" figure it is only part of the picture. Chaplin may well be *outside*, in certain respects; but Chaplin is also very much *inside*. This is true in at least two respects.

One of the many striking anomalies in Chaplin is how often money is associated with lower class rather than upper class characters—and usually with *big* lower class characters, men who come, despite their lower social status, to stand for the system of exchange which exploits and excludes. We see this in *The Immigrant* when the bearded "cowboy" steals the money from Edna's mother, and also in the figure of the big waiter, played (like so many of these men) by Eric Campbell, who does not hesitate to pummel a customer for coming ten cents short of paying his tab. We see it again in *Easy Street*, again personified by Eric Campbell, who is first seen in the midst of a brawl—at brawl's end he collects the coins which the defeated

policemen have left behind with their pants. In *A Dog's Life* we see several such exploiters: the heavy-set proprietor of the Green Lantern dance hall who insists that Edna flirt with the customers, and also the two thugs who mug the rich drunk for his wallet (which wallet eventually takes on a life of its own before finally being delivered to Charlie by Scraps the dog). All of which leads us (and perhaps Charlie) to the conclusion that being "lower class" and being "outside" are *not* the same thing (as is usually assumed). Rather, being "lower class" in Chaplin is still to be "classed," is still to be "classified," is still to be *inside* the system of social distinctions. And the question which is effectively and repeatedly put to the Chaplin character is whether he should *want* to have any part of the system which enforces those kinds of categories.

The posing of that question involves a second kind of "insideness" on Charlie's part—one which eventually requires a *rejection* of the insideness implicit in the structure of society. Contrary to the implications of the Chaplin myth as normally presented, the tramp is often characterized less by his status as a social outcast than by his desire to *belong* to society. Indeed, there are a great many films where the Charlie character *already* belongs to society—by virtue of employment s in *The Fireman*, *The Count*, *The Pawnshop*, *Modern Times*) or established wealth (as in *One A.M.* or *The Cure*). But even in those films where Charlie is clearly an outcast or a lowlife of one variety or another, it is often true even early on that the Chaplin character seeks to *enter* society. Such is obviously the case in *The Immigrant*. *Easy Street* begins with Charlie waking up and going into the mission. *Modern Times*, after Charlie's nervous breakdown, is repeatedly characterized by Charlie's many and sometimes ill-fated attempts to re-enter society, either by getting another job or by returning to prison. And then there are all those moments in Chaplin where Charlie enters, often tentatively, at the door of some public place—the dancehalls in *The Gold Rush* and *A Dog's Life*, for instance, or the restaurant in *The Immigrant*, or the bar in *The Vagabond*—indicating once again a yearning on Charlie's part for some measure of belonging.

Crucial to the revision of the Chaplin myth here proposed, however, is the fact that Charlie's desire for belonging is not a *function* of the society he may inhabit at any particular moment. There is, rather, an idealistic strain to the tramp's "social vision" which finds expression in the romantic gentility of Charlie's relations with women and also in the many "dream" sequences which are found in Chaplin's films. Indeed, what Charlie yearns to *belong to* is not

society as he finds it but rather an ideal society typically associated with sexual delicacy and equality on the one hand and with art on the other.

In *Easy Street*, for instance, it is the sight of the Edna Purviance character playing the organ which awakens Charlie's determination to go straight—and it is in defending her honor that he manages, with the assistance of a fortuitously loaded and placed hypodermic, to clean up the neighborhood. Critics have often questioned the verisimilitude of the final sequence of *Easy Street*, wherein the newly reformed lowlifes all suddenly sport the Sunday morning manners of bourgeois gentility, but the ironic point, quite realistic in its way, involves the quality of exaggeration, almost to the point of abstraction, with which the scene is enacted (the Eric Campbell character and his ordinarily shrewish wife are walking down the street to the "New Hope" mission when Campbell stops and quite gallantly changes positions so that he rather than the Mrs. will be on the curbside of the sidewalk). Only in "art"—or so it is implied—is that sort of social reform likely or possible. Indeed, it is only the intervention of an artist character in *The Immigrant* that saves Charlie and Edna from the prospect of being manhandled by Eric Campbell.

This correlation of art, sexuality, and social harmony is also seen in *A Dog's Life*, *Shoulder Arms* and *The Kid*. In the former film the Edna Purviance character is herself an artist, a singer, whose inability to flirt on command eventually results in the loss of her job. But it is *as* an artist that she first attracts Charlie's attention, and the dream sequence which concludes the film, wherein Edna and Charlie set up housekeeping in the country, is clearly marked as an idealization—by the title card ("When dreams come true"), by the marvellous inefficiency of Charlie's farming technique (planting one seed at a time), and by the picture perfect kitchen with its hearth fire and Edna's dutch-girl costume.

In *Shoulder Arms* the art/sex/dream equation is even more central to an understanding of the film. Here the Edna character is clearly presented as a figure from the world of art (she is framed at one point in medium closeup with a picture of the Madonna and Child immediately over her shoulder—the drapery of Edna's shawl matches that of the Mary in the picture [Fig. 2]); it is for her sake (she had been taken prisoner for sheltering Charlie) that the Chaplin character sneaks into German headquarters and with her assistance then kidnaps the Kaiser, thus "ending" World War I; and the dream-like aspect of this vision of "Peace on Earth" is clearly evidenced when the Charlie character "wakes up"; it really was a dream, the world does not work that way.

Shoulder Arms

Figure 2.

Figure 3.

One Chaplin film where it does work that way, where the dream in some sense does come true, is *The Kid*. Again art is central. The father of Edna's child is an artist at the time of her delivery (so that the Jackie Coogan character is literally a "child" of art, however cruel his artist-father may be); and Edna's eventual prosperity follows upon her success as a concert singer. Moreover, the propriety of Charlie's claim to parenthood is oddly confirmed by the almost painterly manner with which he glazes windows (after the kid has broken them), as if the glazing putty were pigment, and the window were his canvas. Edna is also associated with religion, like the Edna character in *Shoulder Arms*; here she stands outside a church while a wedding party (a young bride, an aged bridegroom) comes down the steps, and Chaplin frames her against a stained glass window, the pattern on the glass behind her serving as halo or nimbus to her agonized countenance. e also get another dream sequence in *The Kid*—though this one is less the film's dream than Charlie's, and it bespeaks a desire to evade the facts of his circumstances.

In the dream he is reunited with Jackie, for instance, despite the fact that Jackie now seems lost to him forever. But the dream is simply another version, flowers or no flowers, harps or no harps, of the life he has recently been leading. He fights over a woman (as he had over the policeman's wife) and with the same local bully whom he had also battled earlier, and when the cop tries to break it up, Charlie is shot trying to escape. No dream, this, but a nightmare. Yet when Charlie wakes, it is to the dream which he has harbored throughout

the film: he is taken to Edna's home and there reunited with the kid. Indeed, he is taken into the dream when he is taken into Edna's house, as if his ascension into the realm of art necessarily removes him from the depicted world of the film.

It is not simply the case, however, that Charlie unerringly abides by this essentially "aesthetic" social ideal—though the myth of the tramp often encourages us to think so. Rather, exactly the contrary is frequently true: far too often he is "inside" in the less positive sense described above, accepting the rules of the social game as it is typically played and playing it with a certain relish. This is certainly true of the Charlie we see in the Keystone shorts (or of the Chaplin we see in *Monsieur Verdoux*, for that matter). Indeed, in many films it is only Chaplin's (always delightful) agility at manipulating social circumstances that distinguishes him initially from his more earth-bound fellows. Thus in *The Tramp* Charlie is only one of several transients we see, as willing as the others, in fact, to resort to thievery—until he sees the degree of Edna's despair and returns her roll of bills. In *Easy Street* Charlie is ready to abscond with the mission's collection box, though once again Edna's presence intervenes. In *The Vagabond* Charlie is perfectly willing to profit at the expense of his fellow sidewalk musicians (he passes the hat inside the saloon while they are still playing outside), and in *A Dog's Life* Charlie doesn't hesitate to steal to survive. Indeed, in *The Pilgrim* he has already done time when the film begins.

The "special force" spoken of earlier, then, involving Charlie's decision to be "the tramp," can thus be seen in this contrast of initial and final states: Charlie often begins as a kind of insider, as one lowlife character among many, who longs simply to be more *inside* than he already is. At the film's end, by contrast, Charlie is often seen *departing*, either literally, by walking down the road, or figuratively, by escaping into an aesthetic dream world—only by *becoming* an outsider can Charlie be true to his better self (i.e., to Edna). The ending of *Monsieur Verdoux*, as André Bazin so eloquently describes it in *What is Cinema?*, represents an especially pointed instance of this motif; in departing the world Chaplin suddenly *becomes* his better self. "A small man in his shirt sleeves, his arms tied behind him, he moves forward toward the scaffold with a kind of a hop, skip, and a jump. Then comes the sublimest gag of all, unspoken but unmistakable, the gag that resolves the whole film: Verdoux was Charlie! *They're going to guillotine Charlie!* The fools did not recognize him" (1971, p. 109).

Indeed, early on Chaplin evolved a narrative *trope* to embody this insider/outsider opposition upon which Chaplin plays in *The Great Dictator* and *Monsieur Verdoux*: the "double" figure.[2] This "doubling" works in two directions (and in this anticipates Hitchcock). On the one hand Charlie is typically set against fellow lowlifes whose actions differ from his own only in degree—as in *The Tramp*, *Easy Street*, *The Vagabond*, and *A Dog's Life*: it's every man for himself. Charlie is typically vulnerable in these circumstances because of his size—but he triumphs (or at least he survives) by virtue of his speed and skill. His vulnerability, however, is also involved in a second sort of "doubling"—that of Charlie and "the girl," usually played by Edna Purviance (Fig. 3). She too is vulnerable—for being diminutive in a world of large-scale greeds—and Charlie's concern for her is partly a response to their common plight. More significantly, in choosing, as he inevitably does, to side with or to defend Edna, Charlie is forced to do battle with characters whose actions are mirrors of his own. In *The Tramp* Charlie's affection for Edna requires him to defend her father's farm from the threat of his fellow tramps—and it is Charlie as the-thief-reformed in *Easy Street* and *The Vagabond* who frees Edna from the clutches of Eric Campbell and or his cohorts. Even in *The Cure*, where Charlie is a highlife rather than a lowlife character, we see the same pattern: Charlie is a sensualist who eventually defends Edna from the unwanted advances of various (often drunken) suitors. Perhaps the most striking early example of this "rejection of the double" notion is seen in *The Pilgrim* where Charlie aligns himself against his ex-cell mate to protect Edna and her mother from financial ruin. Indeed, there is a recurrent scene in Chaplin which captures the force of this kind of moral decision: repeatedly (as in *The Tramp*, *The Vagabond*, *Easy Street*, *The Pilgrim*, even in *Monsieur Verdoux*) Charlie is seen returning money or rejecting the (sometimes implied) offer of it, as if keeping the cash were thoroughly out of keeping with the self Charlie would now be.

Walter Kerr's (1979) observation to the effect that Charlie can be any character he wants to be is thus well taken—but "character" in this context should be understood not simply as a matter of *dramatis personae*. Rather, "character" in Chaplin is frequently a matter of ethical consequence: should he be a tramp or a farmhand, a thief or a cop, a lush or a tee-totaller, a crook or a parson, etc., etc.? And the decision, as the Charlie character eventually makes it, almost always implies a rejection of the social norms which characterize the milieu he inhabits and which, indeed, have characterized his own actions prior to the moment of decision making. Put it another way—it

matters which role Charlie chooses to play and upon what terms he chooses to play it. The problem with the myth of the tramp as it is typically expressed and employed is that it so completely misses the moral dynamics of so many of Chaplin's films. We need a new myth. Consider this a beginning.

STORY AND DISCOURSE: *BEHIND THE SCREEN*

I have suggested thus far that the myth of the tramp drastically oversimplifies the dramatic action and significance of the Chaplin character. It also has the effect, I would contend, of drastically oversimplifying the action and significance of Chaplin's camera—by placing it totally at the service of character: the tramp *acts*, the camera *records*. Among formalist critics, Arnheim (1957) for example, this latter view is equivalent to a charge of cinematic incompetence, as if Chaplin's camera were imprisoned by his essentially theatrical conception of *mise-en-scène*: "In these early films, camera and montage serve mainly as technical recording devices for what is acted out on the scene, and are therefore unessential" (p. 151). Some more recent Chaplin critics have been far kinder, seeing his "passive camera" as both technically and thematically *necessary*, in the words of Gerald Mast, to "the subtle delicacy of Chaplin's gesture and expression" (1979, p. 65). And Nöel Carroll goes Mast one better, arguing that "the composition in *The Gold Rush* is, without a doubt, exceptionally studied," underlining "the difference between the Tramp and others by means of foreground/background juxtapositions, scale oppositions, blocking, sight lines and costuming "(1979, pp. 43, 46).

I would hardly wish to disagree with the premise underlying such praise of Chaplin's *mise-en-scène*, the assumption, to paraphrase Mast, that "good" cinematic technique is not *fixed* but rather is a function of the whole of the particular work in question (1979, p. 65). Precisely because technique is relative to theme, however, rewriting the myth of the tramp requires of us a corollary rewrite of the myth of Chaplin's minimalist technique. Indeed, what is most striking about such defenses of Chaplin's camera work is the fact that they do not significantly change the terms of the debate: camera work is still basically subservient to the Chaplin character and to the world he inhabits, though now the subservience is expressive of "an organic unity where narrative content and cinematic style (composition and editing) reinforce each other in articulating a compelling theme of alienation" (Carroll, 1979, p. 49). Such a view of Chaplin's style is problematic, however, because it runs the risk of perpetuating the

myth of the tramp: how else explain "the paradox of how someone who was an incompetent filmmaker came to make so many indisputably great films" (Petrie, 1977, p. 480) except by suggesting that the character recorded on film was of such mythic stature (as, say, a figure of "alienation") that the relative lack of "cinematic" values can safely go unnoticed?

Let us shift the terms of the argument—indeed, let us reverse them. Rather than talk of character and camera let us speak of *story* and *discourse*, to borrow from Benveniste via Brian Henderson (1978, p. 20). And rather than focus primarily on *story*, on what happens *within* the depicted world of the film, on the *enoncé*—let us attend first to *discourse*, to enunciation, to "Chaplin" as speaker, as looker, as "implied auteur." Let us look (at) *Behind the Screen*—not because it will settle the question of Chaplin's *mise-en-scène*, but because doing so will help to raise it. *If* even a Mutual period two-reeler can be described as playing significantly on the story/discourse distinction, *then* arguments that Chaplin is a stylistic primitive will no longer carry the force of dogma.

The reflexivity of *Behind the Screen*, the sense in which it can be described as an instance of self-aware discourse, is evidenced by several features of the film—its subject, its framing, its action, its mode of address.

In certain respects "subject" or "content" is the least important of these features, except to the extent that subject matter—life in a Sennett-like film factory, life "behind the screen"—allows for other possibilities. Put another way, it is *not* the case in *Behind the Screen* that we find ourselves puzzled by the ontological status of particular images. All images (but one—the last) are images of the same world; there are no occasions where we are invited to (re)interpret a particular image as pertaining alternately to *story* and to *discourse*. That movies are *made* is self-evident, including the movie we are watching; but we do not watch the making of this movie, nor do we see the movies which we see being made. Rather, Chaplin's camera adopts an independent stance relative to the lives and actions of the characters of the film, and the question we want to answer involves the implications of that stance. Whose stance? And why this one?

It is commonly observed that Chaplin's camera typically adopts a theatrical perspective—as evidenced, say, by the absence of reverse shots: action is seen frontally, as if through the absent fourth wall of a typical proscenium stage. Such assertions often pose as explanations: *because* Chaplin began as a stage comic, his camera never achieved the mobility often seen in the work of his more cinematically oriented

contempories. Again, story (the world filmed: the stage) takes precedent over discourse (the world filming: the camera). *Behind the Sreen* invites us to reverse the picture, to see things from the other side.

The film's action, that is, does not take place in theatre space but in a far more fluid studio space. At which point the rigidly theatrical *mise-en-scène* can be seen as an assertion, as a stance *chosen* rather than merely *assumed.* In *Behind the Screen* Chaplin-the-director *theatricalizes* space, using the camera to cut it up into *zones* of action which almost seem separate from one another. Thus we get 1) the main studio floor (where Edna begins the film seeking employment as an actress, and where, moments later, a cameraman does his best to keep his tripod upright while Charlie/David repeatedly and, it seems, consciously tries to knock it flat), 2) an Edwardian living room set which Charlie-the-character ("David") dresses while his boss ("Goliath") snoozes, 3) another set, dressed as a renaissance throne room ("the dramatic department") wherein Charlie/David wreaks additional havoc, 4) a storage area where props and costumes are kept, 5) a "garden set," comprising a painted theatrical backdrop and a fake marble fountain, 6) another corner of the studio, where the members of the stage crew eat lunch, 7) a work area where Charlie/David tries to saw a plank, 8) another set, dressed as a western saloon, 9) an adjacent area, where the lever operating a trap door in the saloon set is located, 10) another set ("the comedy department"), dressed as a bakery, and 11) an open area outside the door of the studio where the striking stagehands plot revenge. And the point to make is that the spatial relationships among these (relatively) many sets are very abstract—are not so much a matter of *visual* relationships (only rarely do we actually see two such areas in a single shot) but of *dramatic* relationships: action is continuous though space seems not to be. Chaplin's framing, accordingly, can be read as a "flattening" of space—as imposing a view *upon* it which insists upon the priority of discourse over story. Indeed, not only does Chaplin keep various spaces separate, but he repeatedly films each set (and the action within it) from a single camera position, thus resisting the temptation to add a third dimension to the image by moving the camera through space (on a few occasions he will cut in from long shot to medium shot—though the effect is minimalized by maintaining a constant *angle* of vision).

The fact of the frame, and hence the framer, is also emphasized by action in *Behind the Screen.* Charlie cuts up space into separate zones of action—but the action is such as to harp upon the lines of

Figures 4-7

demarcation. Thus Chaplin repeatedly sets his action at the edge of the frame. When we first see Charlie/David, for example, he is arranging statues on the Edwardian set. Near the right edge of the frame is a statue of a nude female. Charlie looks her over and decides to obey propriety—he moves a male statue to the back of the frame and places it against the same wall, so that the fireplace at the right side of the frame comes between them. More strikingly, when Charlie is called upon to dress the throne room set he picks up a fake marble column and starts "dancing" with it in a mad attempt to keep himself and the column upright—in so doing he repeatedly moves to frame's edge, finally losing control and dropping the column across the frame line, so that it comes crashing down into the adjacent set (Figs. 4-6). Indeed, the gag is doubled when Charlie retrieves the column and pushes it back across the edge of the frame into the throne room set. Or consider Chaplin's treatment of the pie fight sequence. Charlie becomes involved because one actor cannot throw his pies through a door-frame—they keep hitting the wall at the right edge of the frame, as if the frame line *were* a wall.

Furthermore, even when the primary action of a scene is set at frame-center, the consequences of action are also frequently such as to call attention to the fact of the frame—by transgressing it. The column gag is an example of this in certain respects. But a better example occurs in the climactic pie-fight on the comedy set. Charlie—now promoted from stage hand to actor—is supposed to throw a pie at Goliath, and miss, while Charlie is to stand upright and take a pie in the face in return. Charlie does *not* miss, though he *does* duck—at which point Goliath's pie, which was thrown in one shot, and which sails through another (of Charlie ducking), continues on into a third shot, hitting the King on the throne room set full in the face.

It could be argued that what we have here is a simple instance of cutting on action—but there is little sense that action is being used here to *mask* the cutting. Rather, camera angles are such as to *maintain* the demarcations of space, asserting, thereby, an independent perspective on the actions of characters: discourse is *not* subordinate to story.

There is also a sense, however, in which Chaplin-the-director can be seen as transcending rather than enforcing spatial distinctions—those between screen-space and theatre-space. In other words, the "mode of address" of *Behind the Screen* can ultimately be described as one of "direct address" which calls into question absolute distinctions between the world of the film and the world of the audience.

I have argued thus far that several aspects of *Behind the Screen* invite us to attend equally to story and discourse, to the tale and also to the "teller." Largely these features of the film are such as to imply distinctions—of one space from another, of story-space from discourse-space, of subject from camera. But the overall logic of the film is one which finally calls upon us to recognize the "collapsibility" of space, a recognition which requires an acknowledgment of differences at the same time as it encourages us to rethink the *value* of such distinctions.

Thus we can see a *thematic* connection between story and discourse in *Behind the Screen*. In visual terms, as we have seen, Chaplin-the-director takes pains to establish the frame. Also called to attention are a number of well-established social distinctions: *economic* (Charlie begins the film as an assistant stage hand and moves up the studio hierarchy to prop man, to actor, and eventually to director—at least to the extent that he refuses to take direction; Edna begins the film as an aspiring actress and "acts" her way into a job); *temporal* (the renaissance set vs. the Edwardian set vs. the western saloon set); even *sexual* (Edna poses as a boy to get work; Charlie seems attracted to her boyishness, as she is to his girlishness). And the

action of the film story is precisely one which denies the force of such accepted social distinctions—they are *not* absolute, they *can* be transcended and played with, just as Charlie-the-character plays with the opportunities provided by the movie studio, barbering the bear skin rug, for example, or catching Goliath's head in the trap doors of the saloon set.

Indeed, Charlie-the-character effectively becomes an icon of transcendence: he is the one who consistently moves through the space of the studio, shifting props from one set to another; he is the one who wreaks havoc with the studio social routine, playing jokes on every one of his several bosses (turning Goliath's pie tins into an impromptu xylophone, ripping a kerchief to mimic the sound of tearing fabric when the studio head bends over to give directions, etc.); and he is the one, finally, who turns with Edna at film's end to face directly into the camera and wink (Fig. 7), thus acknowledging the world of discourse and thereby collapsing several additional distinctions: of actor and director (Charlie looks at Chaplin), of actor and audience (we are the Chaplin that Charlie looks at), of story-space and discourse-space (the exchange of glances both acknowledges and transcends the fourth wall convention).

Perhaps "transcends" is too strong a word here for implying finality; "mediates" would be better for implying the continued existence of extremes and the necessity for active and ongoing reflection on the value of distinctions. Indeed, it is only by acknowledging the many distinctions which Chaplin posits in *Behind the Screen*—spatial, social, rhetorical—that we are capable of attending to the force and intimacy of Chaplin's filmmaking, and this is true whether we are discussing the myth of the tramp or the myth of Chaplin's stylistic primitiveness: both conceptions are essentially static and both are in essence false, at least as far as they apply to *Behind the Screen*. Rather, it is only by acknowledging the world of discourse in Chaplin—the world of implied author and implied audience—that we can account for the remarkable vitality of Chaplin's filmmaking, which depends far more than is generally understood on the relationship which we as viewers establish with Chaplin-the-director. He plays a role in the world of discourse analogous to that played by the tramp in the world of story: both mediate between extremes and provide thereby a (doubly) resonant image of what it means to be human, as actor *in* the world (Charlie-the-tramp), as dreamer *of* the world (Chaplin-the-director). It bears thinking about.

THE GOLD RUSH

Also worth thinking about, in the larger context of the present discussion, is the canonical status of *The Gold Rush*, the one Chaplin feature in regards to which a critical tradition may be said to exist, and against which the terms of the present discussion may be tested.[3] What does "Rethinking Chaplin" require of us when we attend closely to *The Gold Rush*? And what does rethinking *The Gold Rush* contribute to the picture of Chaplin here developed?

Central to the myth of the tramp—both in its more traditional form and also as I've revised it—is the opposition of *outside* and *inside*. And in many respects the centrality of *The Gold Rush* to our understanding of Chaplin's oeuvre can be attributed to the fact that it plays so thoroughly on the opposition, though not always in a manner genuinely typical of Chaplin's other films.

More specifically, I have suggested that the Chaplin character is often an "insider" in two senses of the word—in the sense that he often functions *within* a system of class distinctions which accords him a lowlife status and to which he often responds by means of thievery, agility, and guile, and also in the sense that Charlie often yearns to *belong* to society, to be a part of it (as, for instance, in *City Lights* where he plays the highlife role on occasion with real relish). The Chaplin character in *The Gold Rush* partakes very little of either sort of "insideness."

Partly this has to do with the very fact of "The Gold Rush" itself—nearly everyone in the world of the film is a "prospector" of one sort or another. The spectre of class—of wealth, of "mountains of gold"—haunts the film and its characters. But in the depicted world of Chaplin's Alaska, class distinctions are relatively weak, especially when compared to those seen elsewhere in the canon. Furthermore, Chaplin's character in *The Gold Rush* seems very weakly connected to the whole "rush for money" syndrome. We first see him alone, not as part of the legion of miners threading their way up the Chilkoot Pass, and Charlie never seems seriously engaged in the hunt for wealth. Nor, for that matter, is Charlie the kind of schemer seen in films like *The Tramp*, *The Vagabond*, *A Dog's Life* or *The Pilgrim* (not to mention *Monsieur Verdoux*). His "schemes," in *The Gold Rush*, are little related to the get-rich-quick longings of the other prospectors (except, perhaps, in the extended sense that *all* desires in the film can be read as a matter of "appetite" or "hunger"). Rather—Charlie does no more than 1) take a few bites of Black Larson's well knawed beef bone, 2) cadge a drink at the Saloon after suffering the

disappointment of Georgia's rejection, 3) mime a massive case of frostbite in order to elicit the offer of food from Hank Curtis (which food he then pays for by looking after Hank's cabin), and 4) shovel snow, in the process of which he unconsciously (at first) doubles the pile in front of the restaurant. In the latter case, however, there is some justice in Charlie's inadvertent con-game (the restaurant owner had turned Charlie down the first time)— and Charlie's purpose in undertaking it is largely to finance the New Year's Eve party he is planning for Georgia and her friends; what money he earns here he gives away (or, at least, spends on others—though they do not show up on time to claim their gifts).

Nor is it the case that Charlie really longs to be a part of the society he encounters in *The Gold Rush*. There is much "longing" in the film, and on Charlie's part, but his longing focuses quite clearly on the figure of Georgia. Here again we see an idealized correlation in Chaplin of femininity and art—Georgia is a dance hall girl (like Edna in *A Dog's Life*). Charlie carries her photograph, and the film's most "artful" sequence (in several respects) is the famous "Oceana Roll" dance which Charlie-the-dreamer performs for Georgia and her dance-hall cohorts. Indeed, Chaplin's empathy for Georgia and her friends can be read very much as a rejection of the oppressively "masculine" society embodied by characters like Black Larson and Jack Cameron, and more generally by the fact that the population in Alaska, apart from the dance-hall girls, is itself almost entirely male. Charlie's empathy here is entirely consistent with that shown by his character elsewhere in the Chaplin canon—but it is also clear in *The Gold Rush* that empathy sets Charlie *apart* as it does not in films like *The Vagabond*, *Easy Street*, *The Immigrant*, or even in *A Dog's Life* or *Modern Times* (both of the latter two films include "dream" sequences wherein Charlie and Edna/The Gamin set up a kind of dream homestead, but still in terms which imply an acceptance of an idealized form of the nuclear family). The tramp's vision of life, while idealized, is typically an idealized version of middle class, home-and-family existence. But in *The Gold Rush* that vision has no real place (or so it seems).

Further evidence of Charlie's "outsider" status in *The Gold Rush*—a status which sets the film significantly apart from the main line of Chaplin's development—can be found in the film's *mise-en-scène*. Partly here I have in mind Nöel Carrol's excellent consideration of the film in *Wide Angle*, wherein he discusses the visual strategies by means of which Chaplin establishes Charlie's social *difference*—the play of foreground (Charlie) and background (the saloon crowd); the

play of scales, small (Charlie) vs. large (nearly everyone else); the play of costume, the dandy (Charlie) vs. the lumberjack (again, everyone else); etc.—"thus literalizing social relationships through visual ones" (1979, p. 44). But equally interesting is the almost literal play in the film between "inside" and "outside." In many respects Charlie is at his best when "outside," even when literally "on the edge."

We see this happy correlation of Charlie and outsideness repeatedly in the film. Thus the first time we see him Charlie walks almost casually along a mountain ledge, twirling his cane, whistling a tune, not terribly upset by the prospect of slipping, not even aware, it seems, of the bear which follows him for a moment. It's as if Charlie were "at home"—indeed, in a film studio (as evidenced by the remarkable contrast between the location footage in the previous sequence and the overtly stylized "wilderness" which Charlie traverses here). A marvelous image of Charlie's creative relationship with his environment here involves his exuberant slide down the mountain just before he checks his "map." When Jim McKay takes him for a chicken, furthermore, Charlie saves himself by running *out* of the cabin; and it is a bear (again) entering through the shed door of the cabin (from *outside*) which saves Charlie from Big Jim's clutches in the following sequence (indeed, the bear saves them both from starvation after Charlie fires at him through the front door with Black Larson's rifle). Charlie's chosen abode, once he arrives at the boom town, is also on the edge—the edge of town; and Charlie gains entry by lying down *outside*, in the snow. Nature is also clearly on Charlie's side (Jim McKay's too) in the next to last sequence, when the threat represented by the cabin's precarious perch is balanced, as it were, by the fact that the storm blew them directly to Big Jim's mine; indeed, it is a rock of Big Jim's claim marker that catches the rope trailed by Larson's cabin and allows Charlie the chance to escape the cabin's plummet off the cliff. And finally it is Charlie's plunge off another ledge, from one deck of the homeward bound cruise ship to another, which reunites Charlie with Georgia, and gives Georgia a chance to prove her basic integrity (in that she offers to hide Charlie, assuming he is a stowaway, and then offers to pay his passage when Charlie is caught). Indeed, Charlie's happiest moment "inside" (apart from the dream sequence) is one wherein he replicates the "outside": after Georgia "accepts" his dinner invitation and departs, Charlie breaks into a kind of whirlwind dance, scattering cans of flour and salt, ripping feather pillows, overturning furniture—until the entire interior of the cabin is alive with something visually akin to snowfall (Fig. 8).

The Gold Rush

Figure 8.

Figure 9.

By contrast, Charlie's more ordinary experience with interiors, with the "inside," is far less positive. Thus in the first cabin sequence, for instance, the architecture cuts down Charlie's running room, particularly while Black Larson and Big Jim McKay struggle for the rifle, which seems constantly to be pointing in Charlie's direction. Or consider the final sequence involving Larson's cabin—the cliff sequence. Overall, I have argued, the outcome of the cabin sequence is positive, in that the cabin becomes a vehicle which transports Jim and Charlie to Jim's claim. From Charlie's immediate perspective, however, from inside, the cabin represents another form of entrapment—the doors are frozen shut, the windows frozen over, so Charlie can neither perceive the danger he and Jim are facing, until he forces the back door open, nor can he singlehandedly effect his own escape, given the tilt of the cabin floor. It takes cooperation—Charlie helping Jim to crawl *up* the floor, Jim tossing a line to Charlie at the last minute. Indeed, the general "precariousness" of society in Chaplin is marvelously captured in the see-saw action of the cabin earlier in the sequence; only by the perfect (if unconscious) timing of their actions can Jim and Charlie keep the cabin balanced

More thoroughly indicative of Charlie's essentially antagonistic relationship with interior space in *The Gold Rush* is the use Chaplin makes of fire imagery, and especially stoves. The first time we see a fire it is in Black Larson's cabin, as he rips up a piece of paper and then feeds a wanted poster into the stove (we see a similar gesture when one of the marshals lights his pipe with paper torn from

another Black Larson wanted poster). It is against this same stove that Charlie burns himself on two other occasions, first while seeking to keep the hunger-crazed Jim McKay at arm's (really rifle's) length, and again during the final cliff sequence when Charlie scrambles to screen left in order to right the balance of the cabin, only to burn his posterior on the stove when he gets there. Another stove, also evincing Charlie's problematic relationship to interior space, is seen in the Monte Carlo dance hall. After the New Year's Eve fiasco Charlie pays a last visit to the dance hall, in search of Georgia. Jack Cameron is there, trips Charlie, and Charlie responds with a show of unconcern leaning nonchalantly on a cast-iron stove and burning his elbow in the process. A related incident, involving fire, is worth brief mention. Charlie, cabin-sitting for Hank Curtis, has sloshed kerosine on his burlap-wrapped foot (he ate his boot earlier). Georgia and her friends then pay Charlie a visit and Betty, after lighting a cigarette, drops her match, onto the burlap. The gag comes full circle, then, when Charlie's flaming foot, resting beneath Betty's chair, warms her rear end (as Charlie's gets warmed later—again the link of Charlie and women).

The importance of Charlie's connection with women in *The Gold Rush* is most thoroughly evidenced by the person of Georgia. The Charlie character, I have urged, is remarkably "outside." There is nothing in *The Gold Rush* akin to those moments so frequently seen in Chaplin wherein "the tramp" comes to realize the degree to which he is "inside" and rejects it emphatically, as he does in *The Tramp*, or *The Pilgrim*, or *Modern Times*. Or rather—the moment is not Charlie's in *The Gold Rush*. It is Georgia who is "the tramp"—in both the negative (sexual) and positive senses of the word.

There are, we might say, two Georgias—as indicated by the two pictures she has taken of herself, one of her in a dance hall hostess dress, the other of her in fur coat and cap (which outfit she wears at film's end). It is the first Georgia that Charlie falls in love with—it is that picture of her which he retrieves from the dance hall floor—and there is a sense in which Charlie's idealization of *this* Georgia connects him, in certain respects, with the other men in the film; it is this picture of Georgia that Jack Cameron, "the ladies' man," snatches away from her in the saloon. To see her in "dance hall" terms—even in his dream Charlie amuses her by doing a dance—is thus to lock her into a role she finds demeaning. She spends most of the film rejecting Jack's advances, declining to take a sleigh ride with him in the first scene, for instance. Indeed, she first notices Charlie after Jack demands she dance with him, tossing a handful of gold to the

musicians, almost as if Georgia's attentions were also to be bought; Georgia decides to dance with Charlie instead.

There is a crucial ambiguity to Georgia's action here. On the one hand her disdain for Jack and the kind of sexual presumption he represents is genuine. Indeed, it is possible to read her cruelty to Charlie during the scene at Hank's cabin as an attempt on her part, on the part of her girl friends also, to get back at men in general, to play with them (with Charlie) rather than be played with, as if they simply cannot believe that Charlie's feelings are any more genuine than those of men like Jack, photo under the pillow or no photo. Hence Georgia's willingness to toy with Charlie's feelings—as when she offers her hand in farewell and then walks slowly off, her arm extended behind her, as if she can't tear herself away. On the other hand, however, it is clear that Georgia perceives her options rather exclusively in terms of the men around her, as if leaving the dance hall is dependent upon meeting "someone worthwhile," as she puts it to one of her women friends.

It is in this sense that Georgia is a thoroughly "inside" character, for despairingly accepting the sexual regimen implicit in her dance-hall circumstances. Georgia's rejections of Jack, for example, are almost always ambiguous, as if Georgia feared losing Jack's patronage and protection. Thus she tells him sarcastically that he can have the photograph of her as she throws it to the floor—but he can still have it; she finally remembers her New Year's Eve date with Charlie, but asks Jack to come along; and even her earlier rejections of Jack in favor of Charlie can be read as provocations, as if she were playing hard to get. Thus when she gives Charlie her rose, as a token of their dance together, she makes a point of doing it right under Jack's nose.

Georgia's only genuinely unambiguous reaction to Jack—a crucial one—comes when they arrive together at Hank's cabin, finding it decorated but deserted. Georgia is moved, tells the others "the joke has gone too far"; but Jack, declaring that "it doesn't matter," forces himself upon her. She resists, slaps him across the face, and leaves, going decisively "outside." It is "the tramp" gesture, of integrity recovered—a gesture normally reserved for Charlie's character (Fig. 9). But here Georgia makes it, becoming thereby the film's moral center, as Edna Purviance was the center of Chaplin's immediately previous film, *A Woman of Paris*. Indeed, despite the despair evident in the apologetic note she writes to Jack the next day, her assertion of moral selfhood pays off, however ironically, when Jack refuses her apology and sends the note to Charlie instead. The payoff is not immediate. Big Jim appears at the same moment and demands that

Charlie lead him back to Black Larson's cabin. But Jack's rejection of Georgia has practical and positive consequence—she leaves Alaska of her own accord, man or no man. And in doing so she puts herself in the right place, literally *outside*, on deck, and so is there to help when Charlie comes tumbling down the ship's ladder and falls backward into the coil of rope. (In the version of the film Chaplin re-issued in 1942, Georgia sends the apology directly to Charlie. The point, in both cases, is that Georgia is a woman of renewed integrity by film's end.)

To see Georgia's role in *The Gold Rush* as essentially "extraneous" is thus to drastically misread the film—though the traditional "myth of the tramp" encourages us to do so, to see everything and every character only as they relate directly to the figure of "the tramp." One advantage, I take it, of the view urged here is that it establishes, even for Chaplin's early films, a more complex matrix of character relationships than that which takes Charlie as the measure of all things. Charlie is not always *a* tramp, nor is he always *the* tramp; another character can play that role, Georgia in *The Gold Rush*, or the Sophia Loren character in *A Countess from Hong Kong*, to take a second example. Another advantage, I would hope, of the view urged here of Chaplin is that it proposes a similarly complex understanding of Chaplin's *mise-en-scène*. To see the complexity of Chaplin's play on the inside/outside opposition in *The Gold Rush* is only to see *part* of the film's complex structure, especially if the terms are applied basically to the social or spatial dynamics of the film's depicted world. To see the film whole, I would suggest, requires us to attend just as thoroughly to a second set of terms. Put another way, the inside/outside opposition as thus far discussed is almost entirely a matter of *story*. Now let us turn to the question of *discourse*, the question of the implied relation of author, story, and audience. What does *The Gold Rush* contibute to our understanding of film style in the Chaplin cinema?

Of course, to speak of *story*, as I have used the term, is to speak about an aspect of the film, and all such aspects or qualities go to make up its "style." Indeed, most discussions of "style" in *The Gold Rush* accord with the"myth of the tramp" by "psychologizing" Chaplin's *mise-en-scène*, reading it as Chaplin's attempt to set the stage for Charlie's comic and romantic exploits, for his *story*. As William Paul puts it: "Chaplin in *The Gold Rush*, as in the earlier films, reshapes the world to suit Charlie's character. Chaplin's unfairly criticized visual style then is solely directed toward this end" (1972, p. 17). The problem with such a picture is that it tends to collapse "Charlie" and "Chaplin," to see the latter as merely the servant of the former; in

seeing Charlie we see all we need to see. In the words of Gerald Mast: "Everything in the Chaplin film, every gag, every piece of business, every thematic contrast, is subordinate to the delineation of the lonely tramp's character" (1981, p. 125). But there is much *more* to see than Charlie alone. Indeed, at every moment we see Chaplin's view of Charlie, a view so strongly assertive in its qualities (Chaplin "reshapes the world," after all) as to establish a contrast between Charlie's acceptance of the world and Chaplin's control over it.

Several things are at stake here, not the least of which is the aesthetic experience which *The Gold Rush* can provide. To collapse Charlie and Chaplin altogether is to miss thinking about much in the film that bears thought—for example, the contrasts which Nöel Carroll (1979) points out, of Charlie's solitude, for instance, as set against the various groupings of characters in the dance hall sequence. To efface the *metteur-en-scène* does not help us much to think about *mise-en-scène*. But I want to focus on those details of film style in *The Gold Rush* which assert Chaplin's presence as an "implicit character" in the film, one quite apart from the tramp-like character played by Charlie.

Many elements of the film connote "movie" and hence "movie-maker." Some of these I have already mentioned, the contrast of the location footage which opens the film, for example, with the overtly studio footage, wherein we first see Charlie, which immediately follows. Or consider the even more overt, though no less marvelous process/studio shots seen in the cabin on the cliff sequence. In long shot the cabin seems a miniature, perched on a miniature ledge—until somehow Charlie appears hanging on to the rear door for all he's worth (Fig. 10). I do not know exactly *how* Chaplin pulled it off, nor does knowing how much matter. It is what we see which counts, and what we see is clearly *some* sort of cinematic sleight of hand. I think of it as "Chaplin's" hand.

Chaplin-the-director's hand is also equally apparent in his framing of action. There is nothing in *The Gold Rush* quite so telling in this regard as is Chaplin's play with frame lines in *Behind the Screen*. But two sequences in particular clearly depend upon a similarly "flat" sense of filmic space, the scene in Black Larson's cabin where various characters are caught in a wind tunnel, which results from opening the cabin's front and back doors (Fig. 11), and also the scene on cliff's edge, when the entire cabin functions as a kind of see-saw. In both cases the humor and the point of the scene depends exactly on a kind of two-dimensionality toward which the camera must adopt, if the

Figures 10-12.

scene is to work at all, a very precise, perpendicular relationship. It amounts to a form of almost geometric abstraction.

Two other scenes in *The Gold Rush* are even more important to establishing Chaplin's status as an implicit character in the film, both of which, it seems to me, amount to virtual declarations of the filmmaking process. One of these I have already discussed—the scene in the Hank Curtis cabin when Charlie suddenly turns *inside* into *outside*; there seems little to choose here between the flying feathers, flour, and salt which Charlie uses to express his delight and the equally ersatz snow seen elsewhere in the film (at scene's end, it is worth noting, Charlie is bestrewn with feathers, as Georgia finds upon returning for her gloves, thus implying a parallel of this scene and the earlier cabin scene where Big Jim envisions Charlie as a chicken; in both cases Charlie is at hazard, at a disadvantage). Far more crucial to the case I am making here, however, is the film's much discussed final sequence, aboard the steamer, which concludes with the reconciliation and betrothal of Charlie and Georgia.

The "declaration" of the filmmaking process in this scene, and of Chaplin's role in it, is remarkably overt though relatively little noticed. The elegantly tailored "Charlie" we see after the "Goodbye Alaska" title looks very little like the increasingly threadbare dandy seen earlier; this could be Chaplin. Indeed, when he first poses for a press photographer his back is to us; even his famous mustache no longer

serves to distinguish Charlie from Chaplin, actor from director (Fig. 12). Of course, he is with Big Jim (or is it with Mack Swain?)—and his status as "Charlie" is reasserted when he picks up a cigar butt and when he changes back into his prospector costume. But the point is how thoroughly Chaplin plays with his dual roles here, both as character and director. Thus it is "as a character" that he accepts the photographer's direction and thereby tumbles down the ship's ladder; but it is "as director," mining clothes or no mining clothes, that Chaplin refuses to *be* directed, kissing Georgia rather than holding the pose as ordered. As the cameraman puts it—anticipating many a critic—"you've spoilt the picture."

Which picture we might ask? Certainly not *The Gold Rush*—though the movie's ending clearly requires us to rethink the film, to see it *as* a film, and as an exceptionally self-conscious film at that. Indeed, I take self-consciousness to be one of the film's central concerns.[4]

Call it a matter of memory—at least in part. Thus two of the film's three central figures, Big Jim and Georgia, are each characterized by forgetfulness, as having forgotten something. In each case, furthermore, forgetfulness correlates with place—and also with Charlie. Jim remembers enough to know that finding Black Larson's cabin is essential to rediscovering his claim, and that Charlie is essential to the task of refinding the cabin; Jim cannot simply be a "lone" prospector. By contrast, Georgia is trapped in her place, the saloon—and it takes her recollection of Charlie's party invitation, as well as the sight of the deserted cabin, to bring about her key moment of self assertion. In both cases "remembering," coming to consciousness, requires another—requires Charlie.

In the film's closing scene, however, another kind of memory or self-consciousness is involved—a memory of the cinema in general, and of the Chaplin cinema in particular. Put another way—Charlie too needs to remember something, needs to remember the "other" who makes his film-consciousness possible. The other is the camera, which is to say Chaplin, which is also to say the audience. I take this to be the ultimate import of the cameraman's "you've spoilt the picture" remark. And the picture "spoilt," in my view, is "the myth of the tramp." There *is* something atypical about the ending of *The Gold Rush*, something contrived, fortuitous, something out of keeping with the pathetic tramp figure audiences (then and now) are accustomed to. But in asserting this ending, Chaplin encourages our consciousness of the expectation, hence of our prior experience with films, and of his films particularly. Only by soliciting our consciousness of him is

Charlie capable of becoming Chaplin. Only by testing our consciousness of Chaplin are we capable of understanding to the fullest the aesthetic experience the film has to offer us. *The Gold Rush* plays a crucial part in this process of remembering, because it has so long been taken as typical of the Chaplin canon. The time has come to acknowledge just how singular Chaplin's films can be, how different from one another, how various. But it is an openness to variety, to otherness, to other people, which his films consistently celebrate. It is well worth the celebration.

Indeed, Chaplin gives us in *The Gold Rush* a very striking set of images for that sort of celebration—the two New Year's Eve parties. Charlie's we have already mentioned, and the "Oceana Roll" dance which Charlie performs in his reverie is one of those marvelous moments in film history when a gesture completely transcends, without in the least denying, its context. Thus, despite the closeup of Charlie, even despite the almost spiritual and inward expression which comes over his face as he "dances," it is clear that Charlie's delight in the dance is very much a function of his "audience," which we do not see but always know to be present, present exactly as we are, off screen. Indeed, at dance's end we can only echo Georgia: "He's wonderful."

More striking in its way, if only for being so little noticed, is the degree to which the Monte Carlo New Year's Eve party partakes of a similar sort of spiritual delight. To be sure, as Nöel Carroll points out, one implication of the cross-cutting between Charlie in the cabin and the saloon crowd involves Charlie's status as an outsider, as a loner. But there are also aspects of the two party sequences which mirror each other, which transcend, as it were, the loneliness which they also imply. Thus the circle of friends dreamed up by Charlie is in many striking respects realized in the Monte Carlo Saloon. Indeed, it is a matter both of art and of memory, of song ("Auld Lang Syne") and recollection. As midnight approaches, nearly everyone in the saloon joins hands and moves together, bound, it seems, by a common sense of loss and isolation, as if their isolation were a form of loss. Chaplin's camera underscores the moment by panning around the circle, from within, as if the camera (the audience) were part of the crowd. And this recollection of community has its epiphany when the song is over; first one old prospector, then another, begins to dance a jig at circle's center—a far more public and efficacious version of Charlie's "Oceana Roll"—after which the entire crowd begins to dance. It is this scene which Charlie witnesses through the screen-like window of the saloon. It is a measure of Charlie's somewhat "atypical" otherness in *The Gold*

Rush that he feels debarred from participating. It measures the breadth of Chaplin's vision, however, that we are empowered to participate, to see, even as Charlie does not, the degree to which both parties express a similar sense of delight, a similar sense of gravity, each quality going with the other, in a circle. It is exactly this sense of tension, of balance, which characterizes Chaplin's social vision in *The Gold Rush*. It is exactly this sense of tension, of balance, of characters with one another, of characters with the camera, which Chaplin effectively acknowledges, urges us to acknowledge and remember, in the film's closing image, Charlie and Georgia kissing despite the photographer's command to "Hold it." Hold it we shall.

NOTES

[1]For discussion of this point as it applies to *The Tramp*, see Poague (cited below).

[2]Bazin hints at this "double" notion in his *Monsieur Verdoux* essay in the second English volume of *What is Cinema?*: "If we correctly interpret the symbolism of these female characters then the whole of Charlie's work would be the ever-renewed search for the woman capable of reconciling him to society and by the same token to himself" (1971, p. 115). Wes Gehring employs a related notion—of "dual focus" narrative—to explore Chaplin's reliance on "incongruity" as a source of comic effect in *Charlie Chaplin: A Bio-Bibliography* (1983, pp. 13-23).

[3]In addition to the Chaplin sources already cited see Callenbach, Durgnat and Lyons on *The Gold Rush*. I should note that the earliest draft of the present essay was completed in the summer of 1983, long before I had the pleasure of reading Julian Smith's *Chaplin*. I especially recommend his excellent analysis of *The Gold Rush*.

[4]In the 1942 version of *The Gold Rush* Chaplin cut out the scene of Georgia and Charlie embracing for the photographer, but the resulting loss of "self-consciousness" is more than made up for by the fact of Chaplin's running voice over commentary. On the one hand, it amounts to the most overt instance of directorial *discourse* in all of film history, thus confirming the picture of Chaplin's active directorial presence derived from my discussion of *Behind the Screen*. Also confirmed, however, is Chaplin's ability to role-play, especially across sexual lines. Chaplin speaks *every* part in the 1942 version, often matching his voice to the lip-movements of the actors—so he is equally as much Georgia as Charlie or Big Jim.

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TEMPERATURE PREFERENCE OF OLDER ADULTS FOR A GROUND BEEF MIXTURE SERVED HOT[1]

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ABSTRACT. Samples of a ground beef and tomato sauce mixture were tasted at four different temperatures by 49 older adults. Participants were primarily females aged 75 years or older and living independently. Temperatures studied were 120, 130, 140, and 150°F (49, 54, 60, and 60°C). The sample tasted at 150°F (66°C) received the highest percentage of just-right responses (84%) and was considered to be the preferred temperature. Accuracy in judgment of relative temperature was 71%; consistency of responses was 70%.

Index descriptors: Food temperature, food temperature preference, older adults.

INTRODUCTION

The expression "Serve hot foods hot" is familiar to most people. But how hot do people like to eat their food? A recent study found that third-grade children responded most favorably to the temperature 120°F (49°C) when they tasted a single entree item at 120, 130, and 140°F (49, 54, and 60°C) (Brown et al., 1984). This temperature was well below the temperature range of 140-145°F (60-63°C) reported for the general population (Blaker et al., 1961). Very limited information is available in the literature on the preferred temperature for eating entrees or other types of food. Likewise there is little indication as to whether age might influence this preference. Because individuals at the low end of the age continuum preferred a relatively low food temperature, a study was undertaken to determine if individuals at the upper end of the age continuum also differed from the general population in their food temperature preferences.

[1]This research is part of a study that contributed to the USDA North Central Regional Project NC-120, Quality and Safety of Foods in Households and Foodservice Systems and is published as Journal Paper No. J-11376 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa 50011. Project No. 2332. Data for this paper were collected by Amy B. Peterson and Twyla J. Gross in partial fulfillment of the requirements for the degree Master of Science.

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The objectives of this study were to: (a) determine the temperature preference of older adults for a specific entree and (b) measure the ability of older adults to accurately judge relative temperature and to consistently assign the same reponse to a given temperature. Data were collected from two groups of older adults, Group I (Peterson, 1981) and Group II (Gross, 1984). Data were collected from each group in two experiments, Experiment A and Experiment B.

METHODS

Product and Temperatures

The product used in the study, ground beef and tomato sauce, was selected for the series of food temperature studies because it was acceptable to most people, and samples were uniform in taste, consistency, and appearance. Product formula was standardized by Norris (1981) and Peterson (1981).

Product temperatures in Experiment A (120, 130, and 140°F or 49, 54, and 60°C) were selected to replicate earlier work with third-grade children (Brown et al., 1984). In Experiment B, the lowest temperature was dropped, and a higher temperature, 150°F or 66°C, was added to reflect a slightly higher temperature limit than suggested for the general population (Blaker et al., 1961). Cooling rates obtained in preliminary experiments indicated that the product should be heated to 123, 133, 143, and 153°F (51, 56, 62, and 67°C) to achieve temperatures at point of consumption of 120, 130, 140, and 150°F (49, 54, 60, and 66°C). The portion was 1 oz. served in a 5 oz. glass dish at ambient temperature; 30 seconds were allowed for portioning and delivering the product.

The product was prepared in batches 24 or 50 hours before each replication and refrigerated. One batch was prepared for each temperature. The product was reheated in double boilers at the data collection site. The temperature of each batch was monitored with a Tele-thermometer (Yellow Springs Instrument Co., Yellow Springs, Ohio 45387); the probe was inserted into a device in the double boiler lid that held the probe vertically 2 ⅛ inches (5.5 cm) from the bottom of the pan.

Subjects and Setting

Individuals aged 65 years or older and living in the Ames community were subjects of the study. Participants were volunteers

who lived in a government-subsidized apartment building for low-income senior citizens (Group I) and in a retirement community (Group II). Researchers conducted the studies in a public lounge or guest room with adjoining kitchen within the respective buildings.

Permission to conduct the study was received from the University Committee on Use of Human Subjects, managers of the apartment building and retirement community, and participating residents of the two facilities. Information requested from participants included age, sex, and eating habits.

Data were collected in six sessions during two-week periods in March and April, from Group I in 1981 and from Group II in 1982. Participants were scheduled in groups of two to four for 10-minute periods in the afternoon.

Participants were seated so they could not observe one another; wooden partitions separated two people seated at the same table. Each person was given an introductory sheet explaining the purpose and procedure for the study. Each participant was presented with a ground beef and tomato sauce mixture, one sample at a time, at three different temperatures during each of the three replications within an experiment. Each sample was portioned and delivered immediately to a participant. The order of presenting the three samples, each at a different temperature, was determined randomly for each replication, but no duplications were allowed within an experiment for a group. The order of presentation to the two groups of older adults was not the same.

Score Sheet

Participants in Group I were given a score sheet divided into three sections, one section for each sample. Response choices were cooler-than-liked, just-right, and warmer-than-liked, as used in an earlier study (Brown et al., 1984). Participants in Group II received three separate score sheets. The marked score sheet was collected when a new sample was presented so responses could not be changed. Participants indicated their responses on a continuum from cooler-than-liked to warmer-than-liked, with just-right being the midpoint on the line.

Data Analysis

The responses to each temperature were counted. The temperature receiving the highest number of just-right responses was considered to be the preferred temperature.

Accuracy and consistency of the responses were evaluated. Accuracy in judgment of relative temperature was defined as the ability of a person to distinguish among the temperatures and identify a logical pattern among the temperatures of the three food samples during each replication. Each subject's responses for each replication were inspected and assigned a score. A score of 1 was given for a logical response pattern. Some examples would be if 120, 130, and 140°F (49, 54, and 60°C) were scored as cooler-than-liked, cooler-than liked, just-right; or as cooler-than-liked, just-right, just-right; or as cooler-than-liked, just-right, warmer-than-liked; or as warmer-than-liked, warmer-than-liked, warmer-than-liked, respectively. A score of 0 was given if the responses to three temperatures were illogical, as for example, 120, 130, and 140°F (49, 54, and 60°C) being scored just-right, cooler-than-liked, and cooler-than-liked, respectively. No score was assigned if an older adult identified all three temperatures as just-right because it was assumed that the individual either had a wide range of temperature preference or could not distinguish among the temperatures.

Consistency in assigning the same response to a given temperature was defined as the ability to respond in the same way to a given temperature from one replication to another. Each older adult's response to a given temperature for one replication was compared with responses for the other replications. For each temperature in an experiment, three comparisons were made: replication 1 with replication 2, replication 1 with replication 3, and replication 2 with replication 3. A score of 1 was given if the response was the same for the two replications being compared, and 0 if the responses were not the same.

FINDINGS

Background Information on Older Adults

Data were collected from 16 subjects in Group I and 33 subjects in Group II. In the total group, there were 45 females and 4 males. Only one participant was aged 65-69 years; all others were 70 years or older. In the total group, 76% were 75 years or older. In Group II, 82% of participants were in this age range.

On the consent form, 70% of the older adults indicated they ate at a moderate speed; 20% indicated they ate slowly. Most subjects (84%) prepared their own meals. Of the remaining 16%, most had meals prepared for them by spouses, relatives, or housemates. Few older adults (10%) ate at least one meal per day away from home. Almost half (47%) indicated they ate at least one meal per week away from home; however, 18% responded that they seldom ate meals away from home.

Responses to Temperatures of Samples

Responses to the three temperatures presented in each experiment are shown in Table 1 for the 49 older adults. Temperatures 120, 130, and 140°F (49, 54, 60°C) were used in Experiment A; temperatures 130, 140, 150°F (54, 60, and 66°C) were used in Experiment B.

The temperature 120°F (49°C) was cooler-than-liked according to three-fourths of responses from older adults. There were no responses indicating 120°F (49°C) was warmer-than-liked. The temperature 130°F (54°C) was considered to be cooler-than-liked according to a majority of responses in both experiments; however, a higher percentage of responses of cooler-than-liked was indicated in Experiment B (63%), where 130°F (54°C) was the lowest temperature offered, than in Experiment A (53%), when it was the middle temperature. There were very few warmer-than-liked reponses for 130°F (54°C). A high percentage of just-right reponses was received by 140°F (60°C). Again the percentage was somewhat lower in Experiment B (67%) than in Experiment A (73%), when 140°F (60°C) was the highest temperature offered. The temperature 150°F (66°C) received the highest percentage of just-right responses of any temperature (84%) and was considered to be the preferred temperature for older adults. There were some responses (12%) indicating that 150°F (66°C) was warmer-than-liked.

Accuracy in Judgment of Relative Temperature

Mean accuracy for the combined group across experiments was 71%. Mean percentage scores for Group I as compared to Group II were higher in both Experiment A (90% versus 67%) and in Experiment B (85% versus 60%), as shown in Table 2. A relatively high percentage of responses from Group II (28%) indicated that all temperatures were just-right; only 5% of responses from Group I participants indicated that.

Table 1. Responses of 49 older adults to three food temperatures in Experiments A and B (see text page 5).

Temperature and response category	Experiment					
	A		B		Combined	
120°F (49°C)	No.[a]	%	No.[a]	%	No.[b]	%
Cooler than liked	113	76.9	—	—	113	76.9
Just right	34	23.1	—	—	34	23.1
Warmer than liked	0	0.0	—	—	0	0.0
130°F (54°C)						
Cooler than liked	78	53.1	92	62.6	170	57.8
Just right	67	45.5	52	35.4	119	40.5
Warmer than liked	2	1.4	3	2.0	5	1.7
140°F (60°C)						
Cooler than liked	32	21.8	41	27.9	73	24.8
Just right	107	72.8	99	67.3	206	70.1
Warmer than liked	8	5.4	7	4.8	15	5.1
150°F (66°C)						
Cooler than liked	—	—	6	4.1	6	4.1
Just right	—	—	123	83.7	123	83.7
Warmer than liked	—	—	18	12.2	18	12.2

[a]Number of responses was 147 (49x3) for three replications at each specified temperature in an experiment.
[b]Number of responses was 294 (49x6) for three replications at each specified temperature in Experiments A and B.

Consistency in Assigning the Same Response

Mean consistency for the combined group across experiments was 70%. Consistency scores for the two groups were similar in Experiment A (67% versus 68%) and Experiment B (73% versus 71%), as shown in Table 3. Both groups were somewhat more consistent in their responses during Experiment B than during Experiment A. Group I was most consistent when responding to samples tasted at 120°F (49°C), whereas Group II was most consistent when responding to samples tasted at 150°F (66°C).

Table 2. Scores of 49 older adults reflecting accuracy in judgment of relative temperature in Experiments A and B (see text page 5).

Group and replication	Experiment and score[a]			
	A		B	
Group I[b]	Total	Mean %	Total	Mean %
1	15	93.8	15	93.8
2	13	81.2	16	100.0
3	15	93.8	10	62.5
Total	43	89.6	41	85.4
Group II[c]				
1	25	75.8	16	48.5
2	17	51.5	21	63.6
3	24	72.7	22	66.7
Total	66	66.7	59	59.6
Combined group[d]	109	72.4	100	68.0

[a]Responses of each person were scored as: 1-logical response pattern; 0-illogical response pattern; no score-all temperatures considered just right.

[b]Possible score for each replication = 16.

[c]Possible score for each replication = 33.

[d]Possible score for each experiment = 147.

DISCUSSION AND IMPLICATIONS

The preferred temperatures of 140 and 150°F (60 and 66°C) for eating ground beef and tomato sauce were similar to the preferred eating temperatures of 140-145°F (60-63°C) for entrees and 145-150°F (63-66°C) for soups indicated by Blaker et al. (1961). The older adults differed markedly from 48 third-grade children (Brown et al., 1984) in their temperature preference for the ground beef mixture. The children preferred 120°F (49°C) (62% of responses), whereas older adults indicated that 120° (49°C) was cooler than they liked (77% of responses).

Older adults exhibited only a fair degree of accuracy (71%) and consistency (70%) in their responses. Similar results (73 and 69%, respectively) were found with third-grade children (Brown et al.,

Table 3. Scores of 49 older adults reflecting consistency in assigning the same response to a given temperature in Experiments A and B (see text page 6).

Group and temperature,°F[a]	Experiment and score[b,c]			
	A		B	
Group I[d]	Total	Mean %	Total	Mean %
120/130	40	83.3	36	75.0
130/140	30	62.5	32	66.7
140/150	26	54.2	37	77.1
Total	96	66.7	105	72.9
Group II[e]				
120/130	73	73.7	61	61.6
130/140	61	61.6	65	65.7
140/150	68	68.7	85	85.9
Total	202	68.0	211	71.0
Combined group[f]				
120/130	113	76.9	97	66.0
130/140	91	61.9	97	66.0
140/150	94	64.0	122	83.0
Total	298	67.6	316	71.7

[a]Temperatures evaluated in Experiment A are listed first, followed by temperatures evaluated in Experiment B.

[b]Each person's response to a given temperature for one replication was compared to that person's response to the same temperature in every other replication. A score of 1 was given if the two responses were the same; 0 was given if the two responses were not the same.

[c]Based on maximum score for each older adult of 3 for each temperature and 9 for all three temperatures.

[d]Possible score for each temperature = 48 (16×3).

[e]Possible score for each temperature = 99 (33×3).

[f]Possible score for each temperature = 147 (48+99).

1984). These inconsistencies and the observation that temperature choices offered seemed to influence the responses imply that many people do not have well-defined reference points for responding to food temperatures. Whether the temperature of a food is cooler or warmer-than-liked or just-right seems to be a relative rather than an absolute assessment, which is influenced to some degree by the temperatures of other samples eaten within the same period of time.

The combination of a preference for the highest temperatures offered and the inability of some individuals to differentiate among the temperatures raises interesting questions. Do people lose their sensitivity to food temperatures as they age? Does it take a high temperature to elicit a response from older people, or have they become conditioned to "hot foods hot" and therefore expect and desire to eat entrees such as ground beef and tomato sauce at the higher temperatures, such as 150°F (66°C)? The literature was searched for answers to these questions, but none were found. Because aging affects other senses, including sensitivity to the basic taste qualities of salty, sour, sweet, and bitter (Byrd and Gertman, 1959; Cooper et al., 1959), and ability to accurately identify foods based on cues from taste and smell (Schiffman, 1977), it seems reasonable to expect that the aging process also affects a person's sensitivity to food temperatures.

Although it is not known to what extent the temperature of a food at the time it is eaten affects a person's assessment of the palatability and general acceptability of that food, it is fair to assume that for some people food temperature may be an important criterion. If one accepts this assumption, the findings reported here should be useful to persons responsible for foodservices within retirement communities, congregate meal programs, or home-delivered meal programs, as well as restaurant managers wanting to increase patronage by older adults in stressing the importance of food temperatures to production and service personnel. Food temperature preference data can be used to develop temperature goals to be met at point of service. The temperature at which a food should be held at point of service will be influenced not only by the preferred eating temperature for the type of food but also by the cooling rate of the specific food or food class and the usual time that elapses between the time the food is dished and the food is eaten (Blaker et al., 1961). The data suggest that conditions should ensure that hot entrees similar to ground beef and tomato sauce are at least 140°F (60°C) and preferably 150°F (66°C) at time of consumption to meet the expectations of many older adults. Temperatures at or above 140°F (60°C)

are desirable from the standpoint of food safety as well (Food and Drug Administration, 1978),

Appearance and texture of foods also affect their acceptance, and these qualities may change markedly as food is held at high temperatures for extended periods of time (Blaker and Ramsey, 1961). For entrees to be hot but not overcooked at time of consumption requires careful scheduling of food production to service to avoid extended holding of the food. If the food is to be transported, as in a home-delivered meal program, the capability of holding equipment to maintain food temperatures during transit should be evaluated. The length of time needed to deliver the meals would also affect the overall quality and temperature of the food at the time it is delivered and consumed.

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SOCIAL INDICATORS OF FAMILY LEISURE SATISFACTION OF TWO-PARENT AND SINGLE-PARENT FAMILIES

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ABSTRACT. The correlates of family life satisfactions and leisure satisfactions were examined among two-parent and single-parent families. Data were obtained from the 1978 Quality of Life Study (Campbell and Converse, 1980). From this nationwide sampling of persons 18 years of age and older, the data were reanalyzed for 1887 two-parent respondents and 748 single-parent respondents. Multiple regression analysis examined the relationship of leisure behavior to both subjective (family, health, self, etc.) and objective (age, education, number of children, etc.) indicators of satisfaction. The two-parent (nuclear) and single-parent families were found to have similar patterns of life satisfactions as related to leisure behavior. The findings suggest that the disruption of the traditional family seems to have little impact on the quality of the leisure experience.

Index descriptors: leisure, recreation, leisure satisfaction, family, single-parents.

INTRODUCTION

The investigation of the nuclear family and single parenthood status is a frequent activity among social science scholars. Research has focused on family life satisfactions (Hicks and Platt, 1970; Glenn and Weaver, 1978; Mancini, 1979), marital quality (Spanier, 1979; Snyder, 1979; Rollins and Feldman, 1970; Lenhall, 1977; Hicks and Platt, 1970; Albrecht, 1979), and the more general domain of the quality of life satisfactions (Andrews, 1979; Andrews and Whitney, 1974; Campbell, 1976; Campbell, Converse and Rodgers, 1976; Clemente and Saver, 1976). The divorce rate has continued to climb since 1970 (Norton and Glick, 1979), resulting in widespread concern for the future of the nuclear family (Bernard, 1979). Interest in the one-parent family, therefore, has increased in recent years, and the concern for high risk children as a result of family disruption is evident in recent literature (Lynn, 1974; Anthony, 1974; Crook and Elliott, 1980).

Spanier and Lewis (1980) have suggested that the use of family leisure satisfactions as an antecedent of human behavior may be one salient research trend in marital family research.

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The concept of family life satisfaction involves the individual member's adjustment, communication, marital happiness, integration and degree of satisfaction within the family unit (Lewis and Spanier, 1979). Family life satisfaction is related to marital quality and stability of families with two-parents. Available literature consistently indicates that family satisfaction is a major contributor to the overall experience of quality of life (Campbell, Converse and Rodgers, 1976). A different approach and one that is increasing in importance is the effect of the single-parent structure on family member's life satisfactions. Rettig and Bubolz (1983) have suggested that degrees of life satisfactions may differ in the single-parent family. Unfortunately, research on the general topic of family life satisfactions and the developmental and social effects on children of disrupted families is a severely under-researched area (Mancini, 1979). Therefore, there are no substantive research data available. In this light, the objective of the present study was to investigate the social-psychological indicators for two-parent and single-parent families, using leisure satisfaction as a dependent variable.

The United Media Enterprise Report (1983) on leisure in America found that despite the wide variety of leisure options available, Americans decide to spend their leisure time, by a significant margin, with their families. However, there is more to family leisure than just spending time together. Kaplan (1970) has argued that leisure is the primary domain in which members of modern nuclear family relate to each other and express feelings. It is becoming increasingly apparent that leisure represents a vital link that maintains and enhances family cohesiveness and sociability (West and Merriam, 1970; Orthner, 1976; Orthner and Mancini, 1978). However, limited sample populations and measurement deficiencies create problems with external validity and generalizability in these studies. Leisure satisfaction within families has been determined to be a factor of family cohesiveness, but these few studies have methodological weaknesses that detract from their overall impact.

In this investigation of the quality of family leisure satisfaction, existing data on marital satisfaction were used to select the array of independent variables due to the limited literature on family leisure satisfaction. A positive relationship was assumed between family leisure safisfaction and correlates of family cohesiveness, but no causality was immplied due to the non-experimental nature of the study. The majority of the independent variables were derived from the past research of Campbell, Converse and Rodgers (1976), Glenn and Weaver (1978), and Mancini (1979).

Demographic or objective variables correlated included occupation prestige, education, age, number of children, and relatives. The second category (subjective variables) concerned the components of satisfaction. Typically not included in previous literature, subjective variables appear to present a potentially meaningful domain of family life quality (Mancini, 1979). Questions concerning respondent's satisfaction related to occupation, health, neighborhood, friendship, finances, self, religion and residence.

The following two hypotheses were tested:

H1. The level of family leisure satisfaction is positively related to the correlates of family life in nuclear two-parent families.

H2. The level of family leisure satisfaction is positively related to the correlates of family life in single-parent families.

METHODS

Sample

This examination was based on interviews conducted in the summer of 1978 by the Survey Research Center, the Center for Political Studies of the Institute for Social Research (University of Michigan, Ann Arbor, Michigan). A multi-stage area probability sampling technique was utilized to select the original sample of 3692 persons 18 years of age and older living within the conterminous United States exclusive of households on military reservations. The analysis was based on the overall sample selection of individuals at a rate of one in 35,490 from 37 states and the District of Columbia.

The original sampling stratification included 74 sample points across the United States. The survey was designed to measure the respondent's perception of their socio-psychological condition and the needs and expectations from life. The overall response rate was 76 percent. The present reanalysis was based on only those respondents who were married (n = 1887) or single-parents (n = 748) who had children living with them.

Instruments

Leisure Satisfaction. A multi-item index was used to assess the satisfaction levels in family oriented leisure bahavior. The index was

developed from previous work by Mancini (1979), and Campbell, Converse and Rodgers (1976). Following item analysis, alpha reliability coefficients of .68 were obtained for the leisure satisfaction instruments. Despite the abreviated nature of the measure, the reliability levels were considered acceptable.

Life Satisfaction. Measurement in this instance was done in a direct manner. Respondents were asked to indicate on a seven point scale the extent to which they were satisfied or dissatisfied with a particular domain regarding their present life. For example, the question concerning family life satisfactions asked, "All things considered, how satisfied are you with your family life—the time you spend and the things you do with members of your family—completely satisfied (1), neutral (4), or completely dissatisfied? (7)." Health satisfaction was assessed by a single item, "Of course most people get sick now and then, but how satisfied are you with your own health?" Additional information concerning the independent variables can be obtained in Campbell and Converse (1980) or from this author.

Statistical Analysis

Multiple regression analysis was used to determine the percent of explained variance of the selected family life correlates have on leisure behavior. Prior to undertaking these regressions, factor analysis was employed to reduce or create new variables which were more insightful. Each correlate set was analyzed with the purpose of reducing multicollinearity and identifying possible satisfaction dimensions which might be meaningfully related to the family leisure experience. In this study, factor analysis was performed using a varimax rotation and the eigenvalue greater than 1.0 criteria for deciding the number of factors to be extracted.

RESULTS

The frequency distribution of leisure satisfaction scores is presented in Table 1. Approximately 75 percent of married and 70 percent of single-parent individuals reported themselves as being completely or somewhat satisfied. Based on this comparison, traditional and single-parent families were not significantly different in their respective leisure satisfaction levels.

Hypothesis 1

The nuclear family unit results are presented in Table 2. Correlations of the individual satisfactions items confirmed Hypothesis 1 in

Table 1. Distribution of family leisure satisfaction scores by family structure.

Degree of satisfaction[a]	Two-parent percent	(frequency)	Single-parent percent	(frequency)	Total sample percent	(frequency)
1. Completely satisfied	27.0	(511)	32.6	(244)	26.2	(962)
2.	29.3	(553)	24.1	(180)	29.5	(1084)
3.	18.9	(357)	13.4	(100)	19.2	(704)
4. Neutral	15.5	(292)	17.5	(131)	15.4	(565)
5.	5.1	(96)	7.0	(52)	5.1	(189)
6.	2.3	(44)	2.9	(22)	2.9	(108)
7. Completely dissatisfied	1.3	(24)	1.9	(14)	1.23	(45)
Don't Know	0.1	(1)	0.3	(2)	0.05	(2)
No answer	0.5	(9)	0.4	(3)	0.42	(15)
TOTAL	100	(1887)	100	(748)	100	(3674)

[a]A seven point scale with degrees of satisfaction ranging from completely satisfied (1) to completely dissatisfied (7).

specific satisfaction domains. Only subjective satisfactions 1, 2, 3, 4, 5, 6, 7, 9, and 14 were significantly correlated with the leisure satisfaction measure. None of the objective measures were significantly correlated. These simple correlations suggest that demographic variables have little influence on leisure satisfaction domains.

Factor analysis was performed on the 15 family life items resulting in the five factors. Factor loadings, displayed in Table 2, resulted in the following factors: (1) subjective family life satisfactions, (2) residence-related satisfactions, (3) job-related satisfactions, (4) status-related, and (5) religion and family relations. To test the combined effect of family life variables on leisure satisfaction, a multiple regression analysis with the five factors as independent variables was performed (Table 3). The five life satisfaction factors together accounted for 50 percent of the variance in leisure satisfaction scores. The betas show that Factor 1 is the strongest predictor, with residence-related satisfactions (Factor 2) and job-related indicators (Factor 3) being somewhat predictive. These findings suggest that leisure satisfaction is related to an individual's positive, subjective life satisfactions.

Table 2. Hypothesis One Test Result: Factor Analysis of Family Life Variables of Two-Parent Units.

Variables	Correlation with Leisure	Factor Loading Matrix[a]				
	Pearson r	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1. Self Satisfaction	.365	**.716**	.061	−.086	−.008	−.005
2. Family Satisfaction	.367	**.687**	.005	.155	.097	−.011
3. Friendship Satisfaction	.377	**.644**	.122	.045	.055	−.056
4. Financial Satisfaction	.318	.472	.321	.246	−.265	−.022
5. Health Satisfaction	.276	.464	.165	−.425	−.203	.178
6. Resident Satisfaction	.199	.151	**.832**	.026	.025	.034
7. Neighborhood Satisfaction	.194	.144	**.823**	.095	−.003	−.064
8. Age	−.082[b]	.013	−.139	**.765**	−.023	.032
9. Job Satisfaction	.155	.217	.046	**.699**	.099	.042
10. Occupation Prestige	−.026[b]	−.017	.022	−.057	**.825**	.035
11. Education	**.077**[b]	.049	−.018	.251	**.791**	−.074
12. Children	−.003[b]	−.029	.146	−.055	−.027	**.721**
13. Relatives	.058[b]	.057	−.023	.335	−.195	**.553**
14. Religion	.073	.050	.204	.126	−.123	−.463
Percentage of variance explained		19.5%	11.4%	9.0%	7.7%	6.9%

[a]Factor loadings of .50 or above in bold face type.

[b]N.S.; all remaining are significant at $p \geq .01$.

Table 3. Hypothesis One Test Results: Multiple Regression Measures of Leisure Satisfaction Among Two-Parent Units.

Independent Variable	Standard error beta	Beta	T	Significance
Factor 1	.006	.515	24.806	.000
Factor 2	.012	.045	2.144	.032
Factor 3	.002	− .053	− 2.684	.007
Factor 4	.001	.023	1.172	.242
Factor 5	.003	.015	.773	.439

Multiple R	.5150	Adjusted R^2	.2852	F	152.357
R^2	.2871	Standard error	1.244	Significant F	.0000

Hypothesis 2

Hypothesis 2 concerns the satisfactions with leisure from the single-parent family perspective. Again, subjective satisfactions 1, 2, 3, 4, 5, 6, 7 and 9 were significantly correlated to leisure satisfaction and shown in Table 4. Objective indicators, except for age, were not significant. The results suggest that the same indicators influence single-parents, as well as the more traditional two-parent units, in the satisfactions related to leisure participation.

Factor analysis resulted in loadings of both subjective and objective life satisfaction domains. The personal and demographic characteristics (age, occupational prestige, education, number of children, etc.) loaded into four factors. The regression analysis (Table 5) revealed that the predictive scores of these factors were not significant. The only strong predictor was Factor 1 with a beta of .551 and a R^2 of .3031.

DISCUSSION

The findings support the basic premise that social-psychological indicators are of critical importance to the quality of family life and leisure satisfactions. A high degree of consistency between traditional two-parent and single-parent families was revealed through the use of multiple regression analyses, which determined the relative importance of selected subjective correlates on the dependent variable of leisure satisfaction.

Table 4. Hypothesis Two Test Result: Factor Analysis of Family Life Variables of Single-Parent Units.

Variables	Correlation with Leisure	Factor Loading Matrix[a]			
	Pearson r	Factor 1	Factor 2	Factor 3	Factor 4
1. Self Satisfaction	.492	**.721**	−.013	.032	.085
2. Friendship Satisfaction	.391	**.707**	−.078	−.029	.095
3. Financial Satisfaction	.414	**.648**	.213	−.215	.097
4. Neighborhood Satisfaction	.265	**.625**	.189	−.017	−.189
5. Family Satisfaction	.323	**.590**	.093	.172	.158
6. Resident Satisfaction	.266	**.585**	.236	.089	−.265
7. Health Satisfaction	.311	**.522**	−.386	−.215	−.066
8. Age	−.164	−.175	**−.767**	−.135	−.096
9. Job Satisfaction	.157	.142	**.711**	.090	.091
10. Relative	.004[b]	.067	.498	−.173	−.436
11. Occupational Prestige	.009[b]	−.038	.058	**.781**	.115
12. Education	−.007[b]	.009	.306	**.767**	.078
13. Children	.044[b]	.008	.196	−.480	.341
14. Religion	.028[b]	.065	.115	.027	**.736**
Percentage of variance explained		23.0%	13.5%	8.7%	6.8%

[a]Factor loadings of .50 or above in bold face type.

[b]N.S.; all remaining are significant at $p \geq .01$

Table 5. Hypothesis Two Test Results: Multiple Regression Measures of Single-Parent Units.

Independent Variable	Standard error beta	Beta	T	Significance
Factor 1	.006	.542	17.319	.000
Factor 2	.003	− .048	− 1.52	.128
Factor 3	.0002	.041	1.310	.1906
Factor 4	.041	− .028	− .910	.3630

Multiple R	.5505	Adjusted R^2	.2993	F	81.330
R^2	.30310	Standard error	1.357	Significant F	.0000

In general, the results of this study suggest that subjective correlates were more predictive than demographic characteristics in the determination of one's quality of life; these findings are supported by Kelley (1980). For both family structures, the degree of leisure satisfaction is strongly related to the subjective satisfactions received from friendship, family, and self associations. Positive feelings about health, neighborhood, and financial considerations also are found to be important contributors to a positive assessment of leisure satisfaction.

The recent disruption of the nuclear family and the increasing percentage of single-parent situations has created concern among certain researchers and observers (Bernard, 1979). Divorce and separation are viewed as an indication of an individual's inability to develop, within marital and family relationships, the satisfactions necessary for a quality life. Others (Bane, 1976; Blechman, 1982) suggest that this alarm is not justified, or at least, not new to our society. The findings of this paper support the latter perspective. The satisfactions in leisure are generally similar for single-parent families when compared to two-parent or the total sample. The regression comparison between the family variations revealed no significant differences in leisure satisfaction indicators. The disruption of the traditional family appears to have little effect on the quality of the leisure experience.

It must be pointed out that the survey methodology in this study has certain research limitations. The data provided by the Center for Political Studies of the Institute for Social Research allows this

investigator no control regarding relevant variables. Therefore, the subsequent user of extant data can only depend on the original researcher's employment of selected factors. In the case of this study, family leisure satisfaction was represented by direct multi-item indicators. The preferable format would be a longitudinal and observational method of data collection where the partitioning of family leisure satisfaction would provide data of the exchanges between spouses and members of the family; exchanges such as communication patterns and stresses, dominance, conflict and association dimensions should be incorporated for a more representative perspective on the quality of life and leisure. Despite these limitations, the data have acceptable sampling methodology, sample size is suitable for multivariate analyses, and the sample is representative of the family structure in the United States.

There is apparent support for the dominant factors contributing to quality of family life being concerned with interactions in family and leisure situations, rather than the demographic variables (Rettig and Bubolz, 1983). The family can provide the context for the exchange of resources and time for participation and interaction. If this interchange is provided through leisure and family interactions, the quality and satisfaction of leisure can be high. On the other hand, if the family does not provide the opportunity for meeting these needs, then the quality of leisure is disrupted. Since the satisfaction of leisure is highly related to satisfaction of total family (Mancini, 1979), then lack of fulfillment in leisure results in the overall reduction of the quality of family life. Family is the vital ingredient in which most persons seek to meet their personal and psychological needs; it becomes critical to provide educational and other support systems to allow individuals to maximize their quality of life and to enjoy the benefits of leisure experience.

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